Southern 'Super Cushion' Cars

... page 17

Cushioned Racks in CNR Reefers

... page 36

RAILWAY
LOCOMOTIVES AND CARS
JANUARY 1961

FOUNDED 1832
AMERICA'S OLDEST TRADE PAPER

New York Central Electrical Shop... page 39

N & W tests 4-year repack period with Absco dust guards

That's right! The Norfolk and Western is now operating 800 cars on test on a 48-month repack period. The Absco dust guard, which does much to make this possible, had already proven successful on an earlier N & W test of 100 cars with stabilized journal assemblies.

Stabilized journal assemblies (provided simply and economically by Absco positive control flatback bearings) now make it practical to keep oil in the boxes. The Absco dust guard accomplishes this by its compression fit in the well, and by its cushion fit on the axle journal with minimum friction.

The Absco dust guard is engineered for long life because it fills the well . . . doesn't drop down onto the journal when the axle shifts laterally, doesn't get damaged when the axle moves back. Yet, with standard steeple-back bearings, it can shift under severe impact or misalignment.

With lubricating devices that permit free oil to accumulate, keeping this oil in the box becomes more important than ever before. The Absco dust guard is a big step in this direction. And it affords immediate economies, too, by paying for itself in oil savings alone. Consult your Brake Shoe representative for full details. American Brake Shoe Company, Railroad Products Division, 530 Fifth Avenue, New York 36, New York.

Quality products cut your ton-mile costs.

COMPARE THESE FEATURES!

Concave fit holds axle clearance to a minimum, keeps friction down.

Resilient synthetic foam fills well, yet permits shifting without damage.

Sturdy core of high-strength plywood resists warping, chipping, impact.

Low cost! Only $1.40 in the 9, 10 and 11 inch journal sizes; $1.80 in the 12 inch size.

A-1450

AMERICAN **Brake Shoe** COMPANY

RAILWAY

LOCO-MOTIVES AND CARS

America's Oldest Trade Paper
January 1961—Vol. 135, No. 1

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REPORT FOR JANUARY


W. M. Keller (left), AAR vice-president and new chairman of the ASME Railroad Division, tells of the progress made by Russian railroads. H. L. Decker, PRR mechanical engineer, describes the design work and tests which produced the 85-ft Trailer Train piggyback cars.

Gangewere Tells ASME of Reading's "Operation Bootstrap"

Intense competition and a tight economy make it necessary for railroads to establish programs to enlist employees' support, E. P. Gangewere, Reading president, told the annual luncheon of the Railroad Division, American Society of Mechanical Engineers, on December 2 in New York.

Mr. Gangewere told how the Reading secures its employees' backing through a program called "Operation Bootstrap." This program starts, he said, with the "basic premise that, despite some of the differences we sometimes have with our labor organizations, we have infinitely more things in common than those that draw us apart.

"We ask for help and, naturally, we want new business, but we want to make it clear that our company is a business in which management and employees have a real stake."

At the luncheon, Mr. Gangewere; R. L. Wilson, vice-president, engineering, American Brake Shoe Co. and chairman of the Railroad Division, and H. L. Decker, mechanical engineer, Pennsylvania, were honored by being made Fellows of the ASME. The new chairman of the Railroad Division —W. M. Keller, vice-president research AAR—told of technical developments observed on the Russian railroads during his 6,500-mile trip through the USSR as a member of the U.S. exchange delegation (RL&C, September 1960, p 9). Progress in the field of railroad mechanical engineering is substantial, Mr. Keller reported. The rail equipment, while not up to United States standards, is improving, notably through the use of four- and six-wheel trucks, automatic couplers, automatic air brakes, and larger capacity cars. Electrification and dieselization are progressing.

Mr. Keller paid particular attention to the education and research programs. This work is extensive, but much of the training is to improve craftsmanship in the railroad arts. Extensive education of the formal type was also observed, but there was no evidence of superiority over the same kind of education in the United States.

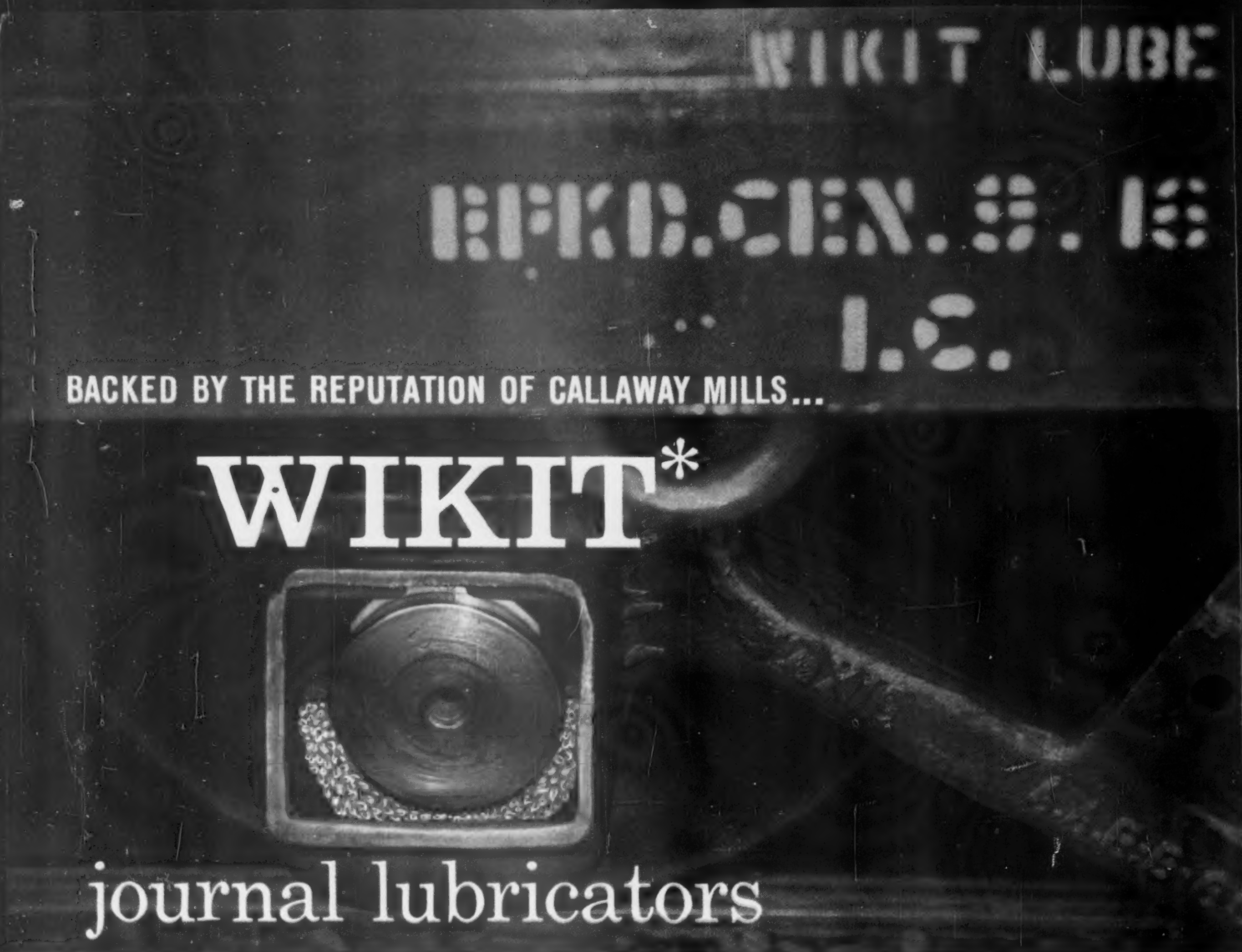
"The advances in Soviet mechanical engineering show strong evidences of having been achieved by close attention to foreign railroad equipment developments, notably those in the United States," Mr. Keller concluded. "The Soviet government is not sparing manpower, money, or laboratory equipment to promote research and development for railroading. The program is more extensive than that of any other single railroad system. However, the success of any

TIME SAVING IDEAS FOR JANUARY

MOTIVE POWER AND CAR

ELECTRICAL

DEPARTMENTS



BACKED BY THE REPUTATION OF CALLAWAY MILLS...

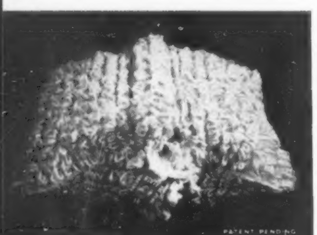
WIKIT*

journal lubricators

quality-engineered for lasting dependability

AAR CONDITIONALLY APPROVED

WIKIT Journal Lubricators are designed and manufactured by Callaway Products, Inc., with a single objective —*to provide effective lubrication continuously under all operating and weather conditions.* To this end, all materials used in WIKIT lubricators are the highest quality, selected for long life, efficient wicking properties, and ease of renovation. Every WIKIT meets the high standards of Callaway Quality—proved by top performance records.



Economical to use because of WIKIT's moderate initial cost—easy, inexpensive renovation.

Center wick design provides shortest and most direct oil flow to journal. LOOP-TITE* jacket, woven by a special process, has interlocking loop pile with high tensile strength. Over-all design assures rapid, multi-feed wicking throughout lubricator.

ABSORBenized* treatment of jacket provides greatest wicking and absorbency—a special process featured in famous Callaway bath towels.

WIKIT #11 retains 7 pints of oil after saturation and draining 3 hours. Cores are best quality neoprene foam—resistant to oil, moisture, heat, compression set. Strong nylon tape secures nonferrous pull handle. Insert either end first, either side up!

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CALLAWAY MILLS

program must be measured by results. Compared to the United States, the USSR is still behind, but progress is being made."

Chesapeake & Ohio Railvans are now moving mail and express between Detroit, Grand Rapids, and Muskegon, Mich. These combination rail and highway trailers, under development since 1952 and in revenue service since early 1959, were discussed by G. J. Sennhauser, development engineer, in the C&O research department. The road now owns eight of these vehicles and has operated all of them coupled together in a single train.

The trailer, equipped both with conventional highway wheels and a special single-axle railway truck either of which can be positioned by an air-actuated mechanism, is designed for operation in trains of 200 Railvans. Currently, they are operated at the rear of passenger trains behind a special adapter truck equipped both with the regular railroad coupler and the special Railvan coupler.

Although, at the outset of service, a number of mechanical shortcomings arose, most of these have been corrected. To date, Railvans have run over 500,000 miles with an availability record of over 90%. In general, the mechanical proving phase of Railvans is virtually completed. The equipment has been tested and developed to a point where it may be safely produced in production quantities. At the present time, the C&O is conducting a market survey to best determine where additional Railvans can be most advantageously used. The Research Department is actively engaged in making feasibility studies for different Railvan body types and a different suspension system using air springs which shows promise not only of improving the riding characteristics, but also of substantially reducing the vehicle cost.

AAR Modifies Standard Packing Iron

A modified packing iron has been recommended by the AAR Mechanical Division as a replacement for the design shown in Fig. 3, page 24, of the Lubrication Manual. As modified, the tool can still be used for adjustment of waste packing. It replaces the sharp-pointed V-blade of the standard packing iron with a slightly indented and rounded contour so as to prevent much of the damage done to lubricating devices when servicing journal boxes.

Compliance with the 90-day lubrication check of cartridge type journal bearings is stressed in a recent directive of the Mechanical Division. The division has received reports that all of the requirements of Rule 66-B are not being generally observed and that, as a result, some failures have occurred. The rule reads as follows:

"Cartridge type journal bearings which have not received periodic lubrication attention within 90 days as indicated by stenciling on the car must be checked and AAR standard journal-box oil added where necessary to restore to maximum oil level, after which filling plug must be properly replaced. . . ."

Ultimately, the division expects to extend the relubrication of some of these devices, and permission has already been granted to

Orders and Inquiries for New Equipment

Placed Since Closing of Nov. Issue

Diesel-Electric Locomotive Orders

ILLINOIS CENTRAL. *Electro-Motive:* 1 E-9 passenger locomotive. Cost, $252,000. Part of 1961 equipment program which includes freight cars listed below.

Freight-Car Orders

DETROIT, TOLEDO & IRONTON. *Pullman-Standard:* 100 50-ton, 50-ft 6-in. box cars. Estimated cost, $1,250,000.

ERIE-LACKAWANNA. *Bethlehem Steel Corp.* 100 85-ft roller-bearing piggyback flat cars. Cost, approximately $1,500,000. Delivery began in December.

GREAT LAKES STEEL CORP. *Thrall:* 30 70-ton gondolas. Estimated cost, $250,000. For March delivery.

ILLINOIS CENTRAL. *Company shops:* 750 50-ft double-door box cars, and 731 70-ton hoppers (231 carried over from 1960). The IC's 1961 $11,000,000 equipment program includes these cars, the locomotive listed above, and the purchase of 100 70-ton covered hoppers and 25 Air-Slide cars.

MILWAUKEE. *Pullman-Standard:* 650 50-ft box cars and 100 50-ft box cars, all equipped with roller bearings, 9-ft doors and nailable steel flooring. This $7,500,000 order included in road's 1961 equipment program which also allocates $3,240,000 for improvements to existing freight and passenger equipment.

MISSOURI PACIFIC. *Company shops:* 300 50-ton, 50½-ft box cars with 9-ft doors and high-capacity draft gear; 200 50-ton, 50½-ft box cars with 9 ft doors, damage prevention devices, and nailable steel floors or equivalent; 100 70-ton, 50½-ft box cars with 9-ft doors, damage prevention devices, nailable steel floors or equivalent, and cushion underframes; 200 70-ton, two-bay steel covered hopper cars of 2,055 cu ft capacity; 50 70-ton, 53½-ft flat cars, and 250 50-ton, 50½-ft box cars with 15-ft double doors. All cars to be equipped with roller bearings.

NORTH AMERICAN CAR. *Thrall:* 35 3,500-cu ft capacity covered hopper cars. For lease to United Carbon Co., Houston, Tex.

NORTHERN PACIFIC. *General American:* 5 70-ton, 3,500-cu ft Dry-Flo covered hoppers. Delivered in December.

WESTERN PACIFIC. *Thrall:* 50 70-ton, 56-ft flat cars. $500,000 order completed in December.

Passenger-Car Orders

NEW YORK CITY TRANSIT AUTHORITY. *St. Louis Car Co.:* 60 additional subway cars. Approximate cost, $7,300,000.

TORONTO TRANSIT COMMISSION. *Montreal Locomotive Works.* 36 transit cars.

Notes and Inquiries

Louisville & Nashville. 900 general-purpose gondolas and 900 open-top hopper cars ordered from Pullman-Standard as reported in December issue, will be 70-ton cars, all equipped with roller bearings. Immediate delivery.

Rio Grande improvements program for 1961 involves $2.1-million for purchase of 150 70 ton, 2,000-cu ft capacity covered hopper cars equipped with roller bearings; acquisition of a dynamometer car and diesel engine test facility to permit continuing investigation into use of inexpensive fuels under adequate testing procedures, and improvements to existing equipment.

---

operate certain cars in interchange on the basis of Rule 66-B. However, the mechanical design of many of the earlier bearings in service requires that they be lubricated at 90-day intervals.

Land Transportation Winter General Meeting

The Land Transportation Committee of the American Institute of Electrical Engineers has prepared the following program for its Winter General Meeting which will be held in the Statler-Hilton, New York, January 31 through February 2:

TUESDAY, JANUARY 31

2 p.m.

Contact Wire Wear — K. H. Gordon, electrical research engineer, Pennsylvania.

A Justification of Railway Electrification, H. C. Cross, manager, Apparatus Parts Dept., Westinghouse Electric International Co.

Electrical Control Equipment for Disneyland Monorail Trains—J. J. Stamm, Westinghouse Electric Corp.

WEDNESDAY, FEBRUARY 1

9 a.m.

A New Concept in Diesel-Electric Locomotive Design—J. C. Aydelott, advance locomotive project engineer, General Electric Co.

Unique Features of 2,500-Hp Diesel-Electric Locomotive—J. C. Aydelott.

Senate Subway System—W. L. Rubel, architect of the Capital; W. H. Watson and R. E. Stillwagon, Westinghouse Electric Corp.

2 p.m.

Electrical and Diesel Power on Russian Railroads—J. W. Horine, electrical engineer, Pennsylvania.

Symposium on British Electrification Conference—S. V. Smith, assistant electrical engineer, Pennsylvania; H. H. Duehne, assistant mechanical engineer—electrical, New York Central; K. A. Browne, director research, Chesapeake & Ohio; J. Stair.

THURSDAY, FEBRUARY 2

9 a.m.

Epoxy Resins for Electrical Apparatus—I. H. Elbling, Westinghouse Research Laboratories.

Analog Simulation of Automatic Train Operation—R. C. Buck, General Railway Signal Co.

Maintenance and Rehabilitation of Traction Electrical Equipment—D. E. Stafford, chief engineer, National Electric Coil Co.

Letters to the Editor

"There's Always Another"

TO THE EDITOR:

I have read with some interest the editorial entitled "There's Always Another" which appeared in the October issue of Railway Locomotives and Cars and feel that I cannot let the statements made therein pass without offering some comments thereon.

The conclusion to be reached from reading your editorial is that, in going to car journal lubricators to alleviate the hot-box situation, there has been established the new problem of oil on the rails and that there is, as of now, no solution for this new problem.

During 1957, service tests were run on the Pennsylvania Railroad between Altoona and Enola during which the oil consumption on boxes equipped with seven different types of lubricators, as well as boxes packed with roll waste packing, was carefully measured with free-oil levels in the journal boxes ranging from 1 in. to 0 in. and back to 1 in. in increments of ¼ in.

(Continued on page 45)

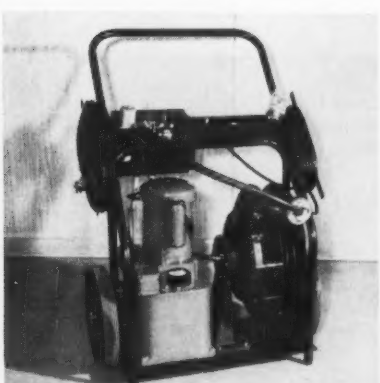
Electro-Motive's GP-20 demonstrates

UNIT REDUCTION


5628
5628

Load Dividers

One man can operate the Preco dividers now being installed in refrigerator cars, insulated box cars, and other types of freight cars. Elimination of center rail in ceiling gives unobstructed head room for load and lift trucks. A single lever, operated from either side, is raised to unlock the dividers for positioning. Damage to the inside of the car is avoided because the gates cannot be left in an unlocked position. The design is said to have resulted in more than 1,000 lb weight reduction over units of comparable strength. *Preco Incorporated, Dept. RLC, 6300 East Slauson ave., Los Angeles 22, Calif.*



Diesel Engine Barring Device

The Ajax electro-hydraulic Push-Over is designed to rotate diesel engine crankshafts for inspection of rings, pistons, and cylinder liners, or for re-set timing. It features a one-man operation with start-and-stop pushbutton control to give regular speed for fast inspections and slow speed for precise spotting on a timing mark. The device is powered with a 1-hp, 110-volt, a-c motor. The capacity of hydraulic pump and solenoid valve is 3 gpm at 500 psi. Tubing from the main unit to the pushing cylinder is mounted on an automatic hose reel. The pushing cylinder when positioned at the flywheel requires no bolts or toggles and exerts a force of 1,500 lb. The unit can also be used while doing generator work. *Ajax-Consolidated Co., Div., Southern Electric, Inc., Dept. RLC, 8701 South Greenwood ave., Chicago 19.*

Airless Spray Equipment

The Hi-Spray line of airless spray equipment is available in 10 different models, portable and stationary, for handling all types of paints, including water base. A self-contained locking devices immobilizes both wheel roll and caster swing, enabling the equipment to be used on inclined, as well as flat, surfaces. Visible pump oil supply is standard on all models.

The double-action pump and high fluid pressure at the nozzle (1,650 lb from 75 psi air pressure) make possible the use of two guns from each pump. Each gun may be operated up to 75 ft from the pump. In interior or exterior maintenance work, two gun operators, it is said, can cover more area with less paint in less time on all types of surfaces, including rough and porous. *Hi-Spray Div., Balcrank Inc., Dept. RLC, 10 Disney St., Cincinnati 9, Ohio.*

Journal Box Seal

The Oiltite journal seal is made from synthetic rubber reinforced with ⅛- x ⅜ in. flat steel inserts around the periphery and a ¼-in. diameter steel insert around the journal fit. The inside diameter of the seal is less than the outside diameter of the dust guard land of the axle to insure a tight fit. It is said to eliminate oil loss at the rear of

the box, regardless of the level of free oil, and give perfect performance without journal stops, special bearings, etc. The seal is available in 5 x 9, 5½ x 10, and 6 x 11 in. sizes, and is AAR approved for 1,000 car sets in interchange. *Railway Car Equipment Co., Dept. RLC, 1400 E. Tremont st., Hillsboro, Ill.*

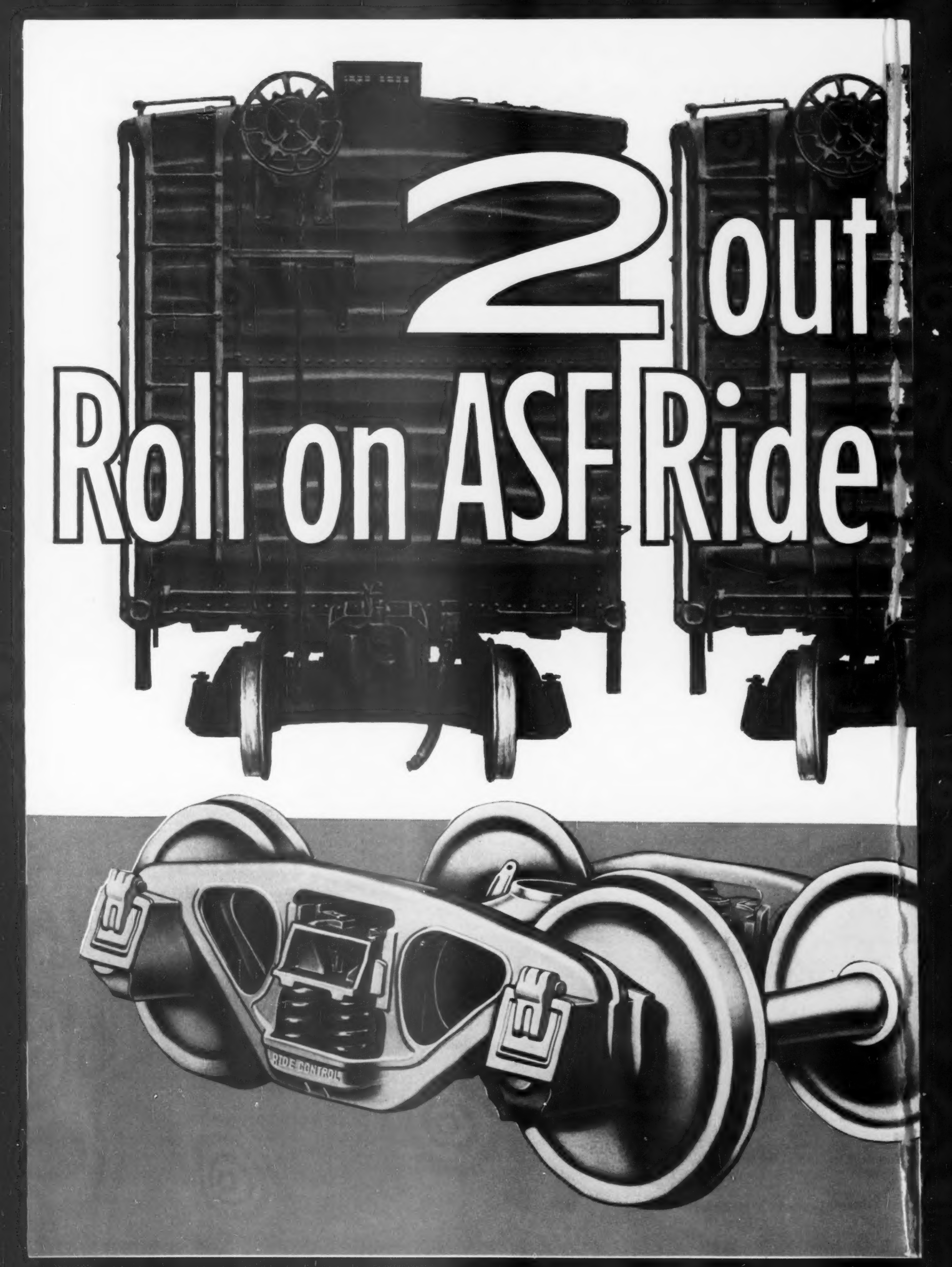
Polyurethane Sealant

Black U. I. Sealant 829-901 is a soft, high-modulus composition which can be applied with a caulking gun or a knife. It comes in a single package, requires no field mixing or curing accelerators, and does not shrink on aging. Its adhesive properties will withstand changes in temperature within the range of minus 75 deg to 150 deg C. The sealant, it is said, will not slump or sag in vertical or overhead installations, even in joints as wide as ¾ in. *Public Relations Dept., E. I. du Pont de Nemours & Co., Dept. RLC, Wilmington, Del.*

Journal Lubricator

The Landreth-Pak twin lobe pad features an 8-in. wide wick sewed to the outer cover

(Continued on page 45)


2 out
Roll on ASF Ride
RIDE CONTROL

EDITORIALS

Let's Stick to Facts

Other publications, here and abroad, have been presenting claims and counter-claims by diesel-electric and diesel-hydraulic locomotive adherents. These discussions are both educational and worthwhile when authors confine themselves to engineering data and demonstrated performance facts. But when they stray into expressions of prejudiced opinion, hearsay, and unconfirmed information, such discussions can be misleading, sometimes downright harmful.

We believe that motive power must demonstrate its value by service performance. Once any motive power type can prove its superiority in hauling trains then the choice of motive power depends simply on the answer to one question: What kind of locomotive will do the best job at the lowest cost? The diesel-electric proved that it was both better and more economic than steam power. It did so because of its inherent characteristics and in spite of exaggerated claims made by some of its proponents.

The German-built diesel-hydraulic units to be delivered this year to two American railroads must prove their worth in U.S. service, too. In performance tests we are sure that these locomotives will get the best attention with every effort being made to obtain maximum performance from them. Americans abroad may be careless in spending money, but economy-minded American railroads are not investing substantial sums in any equipment without doing their utmost to obtain the greatest possible value out of each dollar spent.

Late this year we anticipate reporting the performance of the diesel-hydraulic locomotives. Until then we believe all published comments and discussions should be limited to factual data without the inclusion of unsubstantiated claims and information.

No Time to Stop

A concept which initially might seem too "egghead" for practical, hardheaded railroaders has proved to be effective in solving a lading damage problem. The article on page 36 tells how auxiliary, spring-mounted damping masses, installed in a refrigerator car, have controlled undesirable resonance and cut damage to beef which is suspended from ceiling hooks for shipment. This is the result of work done by the Canadian National mechanical and research departments. An ASME paper by W. H. Cyr, CNR chief mechanical engineer, has described the final installation and the work which led to it.

A suggestion that the dynamic vibration absorber, invented by Frahm in 1900, might have railroad applications was made by Dr. J. C. Settles, assistant chief mechanical engineer of Buckeye Steel Castings, at the ASME Railroad Division meeting in April 1958. He reported that spring-supported floor sections at the two ends of a car might, when loaded, form the necessary auxiliary damping masses. Wide variations in lading weights seemed to rule out this type of arrangement. The CNR application to overhead meat racks, which carry relatively constant weights, has made it possible to demonstrate the practicability of the arrangement.

Even though the CNR has shown what can be done, it is important to note Mr. Cyr's conclusion: "There is an urgent need for improvement in the riding qualities of existing freight-car trucks, particularly in the higher speed ranges, so that all fragile commodities may be protected adequately."

Something for the Computer

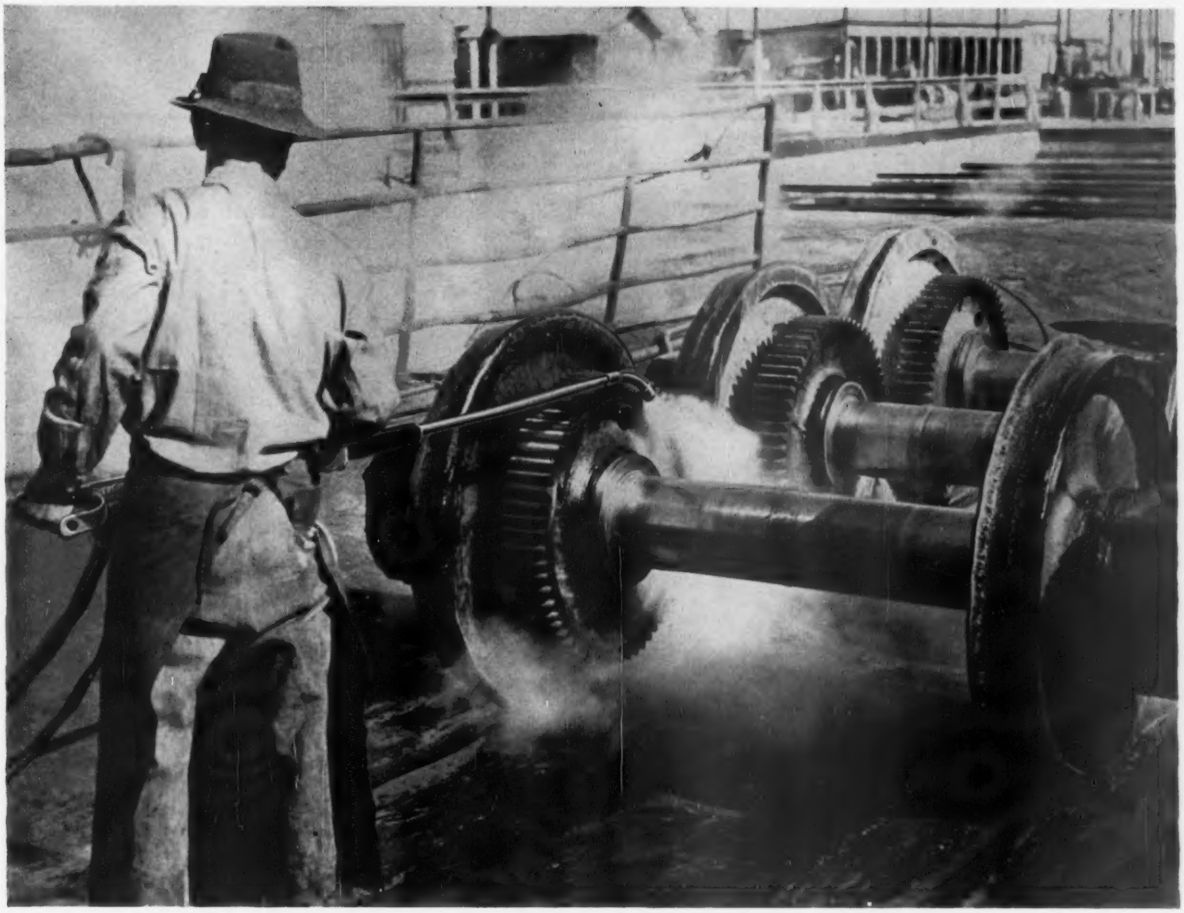
As the railroad situation continues to be bad and the load on the reduced personnel increases, it is logical for those among the executive and supervisory forces to think, "I hope I can last until retirement." But the same desperate situation does offer a challenge. If established methods can not produce results, some new and perhaps very different way out must be found. For those without imagination, the logical procedure is to dispense with operations which show red figures. But reducing the size of the plant also reduces the possibility of making a sizable profit. It all comes back to the often expressed need for fourth dimensional thinking.

One suggestion is offered by costs involved in the British electrification which is now in progress. The overall cost figures of 452 million dollars include 122 million for fixed equipment and 116 million for signal equipment. This corresponds to American experience in which each new electrification has required a change of signals which cost as much as the power supply equipment and contact system.

But over a period of years it is often considered desirable to make basic changes in signal systems for reasons other than electrification. On one American railroad there have been three signal changes since its electrified section was first placed in service. There may be railroad planners who might profitably put these facts into the memory storage device of their future planning calculator.

No railroad in the U. S. is expected to launch a major electrification immediately. But necessity is resulting in mergers. Should these mergers, or any other reason, require basic signal changes, it would appear that it might be well to consider possible future electrification. World practice indicates that new installations will employ commercial frequency (60 cycles in the U.S.) with a contact system voltage of 25,000. Mergers will undoubtedly effect consolidation of traffic which will bring closer the time when reduced costs and improved performance can be effected by electric operation. If the signal system is chosen which is compatable with commercial frequency power supply, the high and possibly prohibitive cost of electrification might be avoided.

Oakite adds more POWER to your MANPOWER



...Hurriclean® Steam-Detergent Gun makes short work of tough cleaning jobs

POWER-UP for the hard jobs of cleaning with the Oakite Hurriclean Steam-Detergent Gun and you'll save money as well as work.

This mechanized muscle-saver uses jet-action to blast dirt and grime. Finest unit of its kind, and the fastest, it strips off soils in *seconds*. It's lightweight . . . only 6½ lbs. It's easy to handle . . . a twist of the barrel aims nozzle at the critical spot, even "up and under." It's safe . . . always cool to the touch.

Big bonus: it cuts material cost, as well as man-hours. By using the Hurriclean Steam-Detergent Gun for cleaning diesel interiors, one terminal slashed the cost of material normally used each month *to less than half!*

Oakite engineered methods and materials give more power to your manpower...take the costly time factor out of maintenance cleaning . . . give you the important advantage: LOW-COST END RESULTS.

The Oakite man or Bulletin F-8055 can tell you more. Send for either one. Oakite Products, Inc., 46 Rector Street, New York 6, N. Y.

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over 50 years' leadership in industrial cleaning

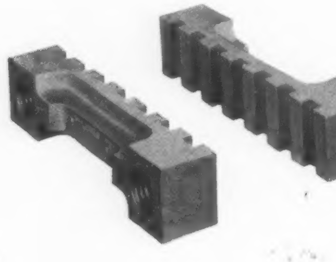
Est. 1909

SCIENCE

STABILIZED JOURNALS—

Now MAGNUS offers you three low-cost ways to get

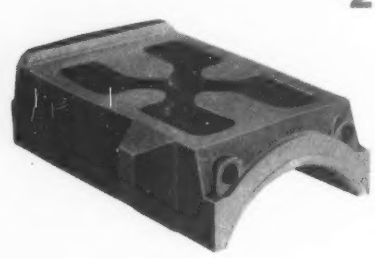
BETTER BEARING PERFORMANCE



1. MAGNUS R-S JOURNAL STOPS

Provide maximum stabilization of entire journal box assembly—increases miles per hot box ten times

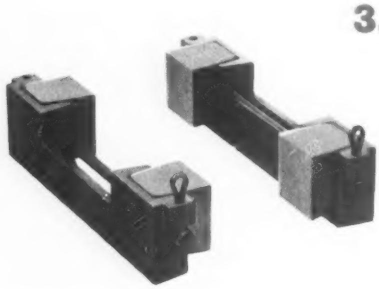
Bolted to the inside of the box, on both sides of the journal, Magnus R-S Journal Stops positively prevent excessive displacement of bearing, wedge or lubricator pad, even under severe humping, braking or road impacts. By stabilizing the entire journal bearing assembly they eliminate the major causes of bearing failures—increase miles per hot box *ten times;* miles per cut journal, *fifteen times!* In short, they cut maintenance and operating costs all along the line—double bearing and dust guard life, reduce wheel flange wear, extend the maximum safe period between repacks.



2. MAGNUS FLAT-BACK SOLID BEARINGS

Wider, non-tilting design limits bearing displacement—provides effective stabilization at lower cost

The Magnus flat-back bearing design provides the most economical means of stabilizing the journal box assembly, and has proved highly effective for many types of service. Its greater width, increased angle of journal contact and full-area contact with the flat wedge inherently limit the fore-and-aft movement of the journal within the box under road shocks and switching impacts. This restriction of movement protects the dust-guard, reduces loss of oil through enlarged dust-guard openings and tends to prevent spread linings in the bearing.



3. MAGSTOPS

Offer the inherent advantages of R-S Journal Stops in a low-cost, rugged, fabricated design

Here's a new approach to the problem of journal box stabilization—a low-cost fabricated journal stop with forged steel frames and renewable bronze inserts that hold the journal in the center of the box even under the most severe car impacts. The frames are welded to the inside of the journal box and need never again be removed. Wear occurs only on the brass inserts, which are easily and inexpensively replaced during wheel changes, without any special tools.

The next big step toward better bearing performance will be the adoption of effective means of stabilizing the journal assembly—for this is the most economical way to reduce hot boxes. Magnus, the pioneer in journal stabilization, now offers you *three ways* to achieve this result at low cost. All have been approved by the AAR for test installations in interchange service. Ask your Magnus representative to discuss with you the most effective solution to this problem. Or write to Magnus Metal Corporation, 111 Broadway, New York 4, or 80 E. Jackson Blvd., Chicago.

MAGNUS METAL CORPORATION

Subsidiary of

NATIONAL LEAD COMPANY

GEARED TO PROGRESS P R I MEMBER

Length over strikers with no underframe compression is 58 ft $3\frac{1}{8}$ in. Inside length is 50 ft 6 in. Light weight of car is 74,400 lb.

Southern Box Cars Have New Look

Single-sheathed carbody construction and high-capacity cushion underframe are used

The first large order for cars incorporating the Pullman-Standard long-travel Hydroframe-60 cushion underframe has been completed. The 200 Southern all-steel, single-sheathed, 70-ton box cars, built at the P-S plant in Bessemer, Ala., are going into general merchandise service.

Cushion underframes on half the order are equipped with the P-S hydraulic cushion cylinder and, on the other half, with a Bendix hydraulic cylinder. Structural features of all the underframes are the same. Special equipment on the bodies includes Alcoa aluminum doors, Southern-designed sandwich ends, and P-S nailable steel floors. All side posts and carlines are outside, giving a smooth interior.

The stationary center sill runs the length of the car body, from end sill to end sill. The sliding center sill, built up of two welded AAR 41.2-lb Z-sections, extends through the stationary sill and allows for 30 in. cushion travel at each end of the car. The sliding sill has two slots in its webs at the center, allowing the sill to slide in either direction with the cushion keys passing through it. An angle welded along the lower edge of the slot and a strip along the upper edge compensate for loss in compressive strength resulting from these key slots. The cushion lugs are above and below the horizontal space for the cushion keys. Carbon-steel wear plates are applied along the bottom surface of the sill flanges where they are in contact with the stationary underframe cross-members. Sliding-sill stiffeners act as lateral and vertical wear plates at the crossties.

When the sliding sill is at center position, the cushion cylinder is extended, ready for impact in either direction. The cushion keys at each end of the cushion pocket bear against the cushion key back stops, which, in turn, are welded to the stationary sill. The sliding-sill cushion lugs above and below the cushion key are welded to the inner side of the sliding sill at each end of the cushion pocket. During impact, these lugs move with the sill, compressing the cushion against the opposite key.

The hydraulic cushion generates pressure by forcing oil through a controlling orifice. At the beginning of a stroke, the orifice is fully opened

Car ends are $\frac{1}{8}$- and $\frac{3}{16}$-in. sheets welded on both sides of $\frac{3}{16}$-in. corrugated center.

where the small end of the tapered metering pin projects through. As the piston passes through the cylinder, the orifice is gradually closed as the metering pin fills more and more of the opening. The closure of the orifice is matched with the slowing of the piston to maintain the desired pressure. The orifice is completely closed at the last ½ in. of the stroke, so that the cushion never bottoms steel-against-steel.

There is very little difference between the Bendix and P-S cylinders. In both, the metering pin is designed to provide the most efficient compromise between light and heavy loads, and slow and fast impact speeds.

Hydraulic Cylinders

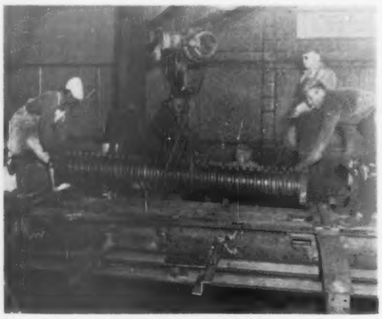
P-S uses a pre-loaded return spring to force the cushion and sliding sill back to center or neutral position. Bendix depends on a column of compressed air ahead of a floating piston. This air is compressed by a volume of oil displaced from the high-pressure oil chamber through the orifice to the low-pressure oil chamber.

Oil passing through the control orifice in the P-S cylinder flows behind the piston and through the piston-rod ports. The piston rod sliding through the cylinder head displaces a volume of ail from the cylinder chamber. This displaced oil flows through the cylinder-head ports into a rubber "boot" which turns inside itself and fills as it receives this volume of oil. The boot is fastened to the cylinder head and piston with hose clamps. After impact, the return spring, preloaded at time of assembly, forces the cushion and the sliding sill back to neutral, and the boot unfolds and collapses, forcing oil back to its original position.

Cushions are self-contained units with no oil pipes and hoses connected to them. Their energy capacity is rated in excess of 500,000 ft lb, and their ultimate capacity approaches 1,000,000 ft lb.

Draft-gear pockets and strikers in the sliding sill are welded and are arranged for special couplers. This is necessary because of the 8 ft 6 in. distance between truck center and striker face with sill in fully extended position. The coupler has a Type E head and Type F butt and is 43 in. long from pulling face to the center line of the Type F yoke pin butt. The king-pin housing is high-tensile cast steel integral with the body center plates.


Sliding sill is assembled in underframe prior to installation of the hydraulic cylinders.


Hydraulic cylinder is lowered into underframe. This is Pullman cushion with return spring.


Completed underframe is moved to production line for assembly in car. Crossmembers and floor stringers are Cor-Ten LAHT steel or equivalent. Nailable steel floor is used.

Brake pipe from angle cock to flexible hose is attached to sliding sill. Other end of hose, main brake pipe, branch pipe, AB valve, and cross-over pipe are fixed to underframe.

Underframe Details

The stationary sill consists of two 41.2-lb steel AAR center-sill sections inverted so that the $^{13}/_{16}$-in. flange becomes the top flange of the sill. The top flanges are joined at the bolster and crossbearers by ⅜-in. top cover plates. The bottom flanges are connected at the bolsters by the body center plate and at cross-bearers by ½-in. pressed connections.

Body bolsters are a built-up design with ¼-in. web plates. Top cover plates are 21 x ⅜ in. and extend from side to side of car. The 24-x ⅜-in. bottom cover plates extend from the side of car and are fastened with high-strength bolts to the stationary sill bottom flange. Side bearing braces are $^{5}/_{16}$ in. inverted U-pressings welded between the bolster webs.

Four crossbearers per car are built-up welded construction, with $^{3}/_{16}$-in. web plates. The 6- x $^{5}/_{16}$-in. top cover

Slots cut in side sheets are backed up with round bars tacked in place to form lading strap anchors. Side is completely welded.

Vertical outside side posts are welded over backs of strap anchors to form weathertight assembly. Car is a single-sheathed design.

End assemblies are all welded. Completed end (left) has sheet welded over corrugated core.

plates extend from the side of car and are welded to the side of the stationary center sill. Bottom cover plates are 8 x $^5/_{16}$ in., extending from the side of the car, and are bolted to the stationary sill bottom flange.

Two 3-in., 6.7-lb Z-bar floor stringers each side of center sill extend in one length between body bolsters, passing over the top of the floor beams and contoured crossbearers. Stringers are welded to the underframe crossmembers. The four floor beams are 4-in., 8.2-lb Z-bars.

Side sills are 4- x 4- x $^3/_8$-in. rolled angles extending from end to end of car. The side plates are 4- x 3½- x $^3/_8$-in. bulb angles, reinforced through the doorway by a 5- x $^3/_8$-in. bar. The side sill is reinforced with a $^5/_{16}$-in. pressed angle, 11 in. deep at center of the car. It extends from bolster to bolster and is welded to the bottom of the side sill. The $^3/_{16}$-in. side sheets, placed inside the side plate and side sill, are automatically butt-welded to

Smooth interior is finished with neoprene-base paints. Interior width is 9 ft 4 in.; height, 10 ft 6 in. Cubic capacity is 4,949 cu ft. Cars have aluminum side doors, LAHT steel bodies.

both. Side sheets adjacent to the corner post are 1/4 in. thick. Corner posts are 1/4-in. plate pressed box sections. Door posts are 5/16-in. pressed angles with a 3/16-in. pressed hat section stiffener. The 20 side posts are 3/16-in. pressed hat sections. There are also two 3-in., 5.1-lb-per-ft Z-bars adjacent to the corner posts on each car side. The side posts are welded on 18 1/16-in. centers. Raised portion of each hat section covers 1 1/2- x 3-in. slots on 8-in. vertical centers which form the lading strap anchors. There are 616 of these anchors per car. A 5/8-in. round bar behind the side sheet on the center line of each side post reinforces the centers of the series of strap anchors.

The ends are a welded sandwich design, each consisting of 3/16-in. plate with 4-in. corrugations between an inner lining of 3/16-in. plate and an outer sheathing which is 3/16-in. plate at bottom and 1/8 in. at top. The bottom outer sheathing is flanged to form an integral end sill. Assembled ends are welded to the corner posts and roof sheets, and riveted to the stationary center sill.

Partial List of Suppliers

Truck side frames and bolsters	American Steel Foundries Scullin Steel
Truck brake levers, bottom connections, brake-rod jaws	Schaefer Equipment
Axles	Tennessee Coal & Iron
Roller bearings	Timken Roller Bearing
Brake shoes	Walker Machine & Foundry
Draft gears; hand brake	W. H. Miner, Inc.
Couplers and yokes	American Steel Foundries
Side bearings	A. Stucki
Brake beams	Chicago Railway Equipment
Air-brake equipment; slack adjusters	Westinghouse Air Brake
Running boards and brake steps (aluminum)	Morton Manufacturing
Doors (aluminum)	Youngstown Steel Door
Defect card holder (aluminum)	Railway Devices

The flat type roof, similar to that used on covered hoppers, is a one-piece assembly of 41- x 3/16-in. panels which are inverted and continuously welded in a jig. The 3- x 2- x 3/8-in. carlines are welded to the outside of roof at the same time the panels are welded together. The assembled roof is welded to the side top chord and top flange of the ends.

Interior sides and ends are covered with one light roller coat of primer and six successive roller coats of neoprene rubber paint. The roof interior has one coat of primer and one coat of hot-spray finish paint. The underframe has one coat of chromate primer and one coat of hot-spray freight-car finish paint after the car is assembled. One coat of chromate primer is applied to the axles.

The Barber S-2-C narrow-pedestal trucks are fitted with 3 11/16-in. travel springs, each cluster consisting of seven outer and four inner coils. Side bearings are Stucki and the Unit brake beams are AAR No. 18. The cars have 33-in. AAR D-33 non-heat-treated multiple-wear rolled-steel wheels mounted on 6 x 11 smooth turned axles with raised wheel seats. Timken greased-packed roller bearings are applied to the 6 x 11 journals.

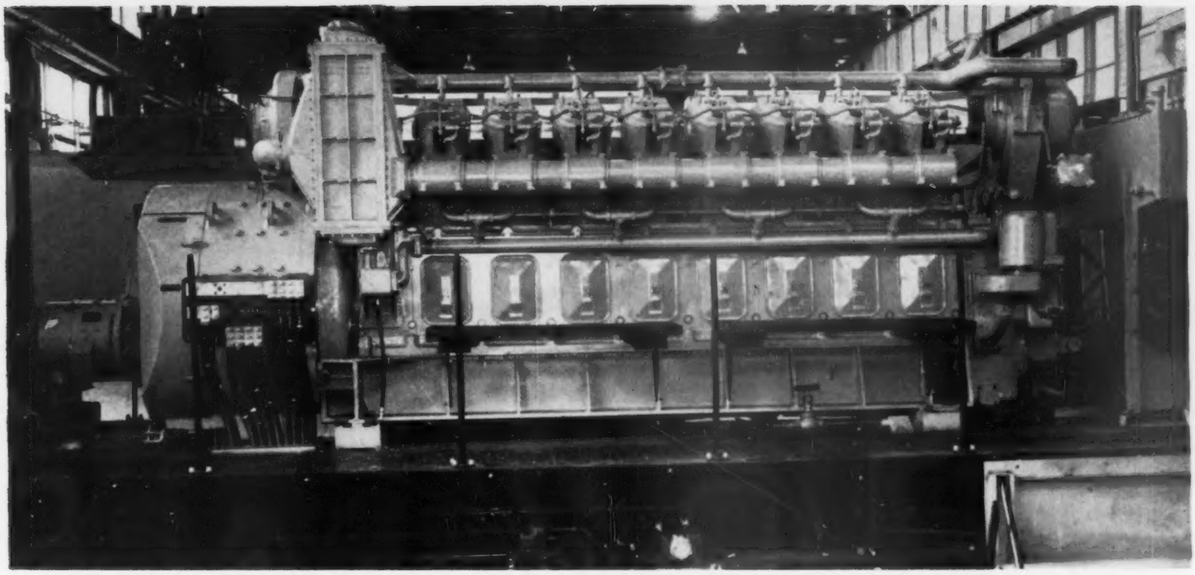
Wabash Designs Trailer Lift

A lifting assembly for handling trailers during salvage operations and for loading and unloading piggyback cars has been successfully tested by the Wabash at its Decatur, Ill., shop and is now in service. The Broderick & Bascom Rope Co., cooperating with trailer manufacturers and railroads, designed and built the device. The actual demonstration lift was 7 tons.

The assembly is applied by lowering it over the trailer. The side rails are lined up along the lower edge of the trailer sides. Snubbing chains pass under the trailer through the opposite side rail and are tightened with ratchet load binders. Adjustment for center of gravity, if needed, is made by loosening the binders, sliding the side rails to position, and retightening the binders. The M1-BT 10-ft braided wire rope slings attached to the lifting beam consist of eight parts of 1/2-in. rope. The twin thimble fittings allow the rope to run completely around the thimble. Assembly weighs 1,500 lb and has a rated capacity of 80,000 lb.

Ratchet tightens chain through side rails for snug fit along trailer sides.

Center of gravity adjustment is easily made.



FDL-16 diesel installed on 2,500-hp road switcher at General Electric plant is result of development work started during 1940's.

GE Diesel Powers 2,500-Hp Locomotive

Four-cycle, V-type engine, product of extensive development program, is prime mover for U-25B

First production model of the General Electric Type 7 FDL-16 diesel engine was put in service four months ago. This four-cycle, 16-cylinder engine is the prime mover which has been designed to power the 2,500-hp U-25B road switcher with which GE has entered the domestic main-line diesel locomotive market (RL&C, June 1960, p 25). The production engine is the culmination of 15 years of design and development. It offers, according to GE, reliable performance, maximum fuel economy, and minimum lube oil consumption. Long life is expected of critical parts, such as bearings, pistons, liners, and rings.

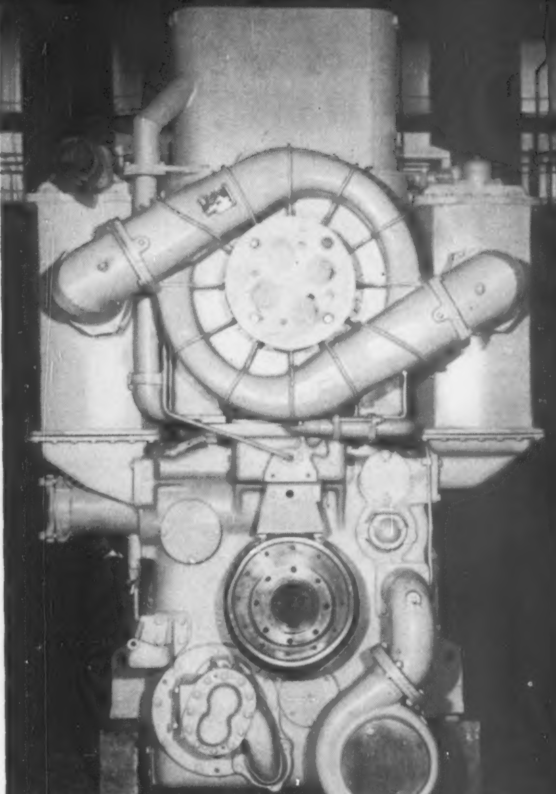
Successful performance of a 4-cycle engine in small and medium power locomotives demonstrated its suitability for traction applications, and a full-fledged development program was initiated in 1953. The latest development, the 16-cylinder engine, has been undergoing extensive tests on demonstrator locomotives operating in fast freight service on numerous U.S. railroads whose officers report highly satisfactory results.

From a paper presented by William W. Peters, manager, Railroad Locomotive Engine Advance Engineering, General Electric Co., before recent ASME Railroad Division meeting.

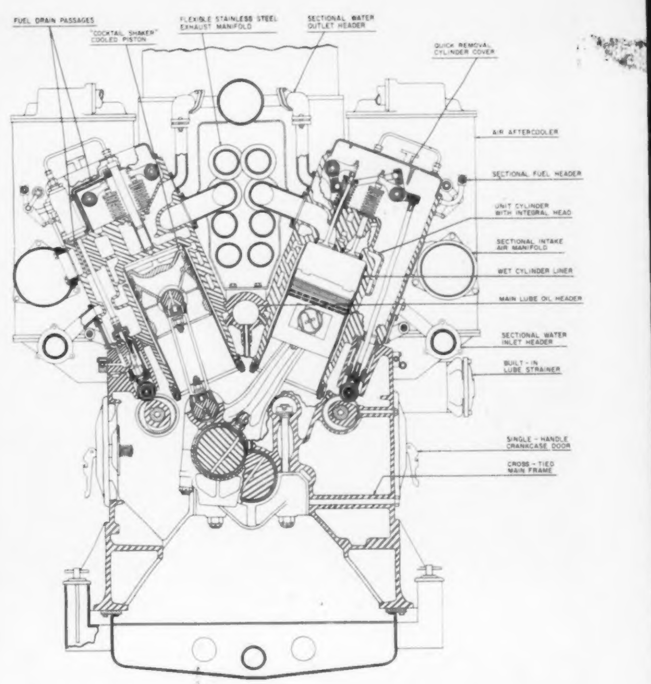
The basic design of FVA series of 6-, 8-, 12-, and 16-cylinder engines was made in the early 1940's by Cooper-Bessemer. By the end of World War II the first 6-cylinder engine had been commercially applied on a GE locomotive. Original engine rating was 110 hp per cylinder, equivalent to 131 psi BMEP (brake mean effective pressure). While the design called for speeds up to 1,300 rpm, early engines were run at 1,000 rpm, and this has continued to be the operating speed. Many basic features have been retained, including the integral head and cylinder arrangement; the four-valve cylinder head with the two intake valves outboard and the two exhaust valves inboard; the cast-iron piston; the bolted piston pin; the cast main frame, and the master-and-link articulated connecting rod system on the V-type engines. While practically every part has been changed or modified somewhat, ratings have been steadily raised to the present value of 204 psi BMEP without alteration of any fundamental engine dimension.

A number of the first production engines, six-cylinder-in-line types, were in operation in the field when it was realized that further development and redesign lay ahead. Principal problems and their solutions were:

- Forged-steel crankshafts were substituted in all engines for the original alloy cast-iron shafts because of the unpredictable service life of the cast shafts.
- Increased thickness of piston crown and ring carrier wall alleviated piston cracking.
- Original rings, particularly top compression rings, would not withstand the high combustion temperatures resulting from insufficient supercharging and were changed to improved alloy rings.
- Hardened grooved piston pins were substituted for the original pins which were too soft and did not have adequate provision for lubrication.
- Improved valves and valve springs were developed.
- Flexible couplings in the fuel rack shaft between cylinders wore, causing considerable unbalance of cylinder loading. Subsequent development has completely eliminated this basic rack arrangement.
- An improved and more efficient turbosupercharger increased the air supply, reducing combustion temperatures.



Turbocharger delivers air to aftercoolers on each side of V-type engine. Design eliminates most external engine piping.



Cylinder and head are a single assembly on the FDL-16 engine. The articulated connecting-rod design has made it possible to increase the crank-pin bearing areas. The V-type design is based on an in-line engine which was first put into service in 1940's. This type of prime mover is still built for lower horsepower locomotives.

By 1950 both the 6- and 12-cylinder engines were giving satisfactory commercial service at 110 hp per cylinder. However, it became apparent to GE that the engine was too costly and too heavy to compete effectively in the railroad field. Surveys and studies were then made to determine whether this basic design offered possibilities for improvement, or whether an alternate design should be considered. GE conclusion was that this prime mover appeared to have the greatest potential for high-horsepower locomotive application. By the end of 1953 it was decided to push development of the Cooper-Bessemer V-8, V-12, and V-16 cylinder engines. In 1954 four locomotive units were built by General Electric to operate as a rolling laboratory on the Erie (RL&C, April 1955, p 65). Two units had V-8 engines operating at 1,320 hp, and the other two had V-12 engines operating at 1,980 hp, both at 1,000 rpm. While this represented about 50% higher BMEP than had been sold commercially, laboratory testing at Cooper-Bessemer showed that proper supercharging would enable the engines to handle these ratings.

Mechanically, the engine has proved to be very rugged, particularly as far as the piston, wrist pin, and connecting-rod bearing are concerned. Because of the bolted pin construction, wrist-pin bearing area is virtually double that found in conventional engines of the same bore. The master-and-link connecting-rod arrangement almost doubles the connecting-rod bearing area for a given crank-pin length. These features, coupled with large crank pins and main bearing journals, plus a rigid main frame, indicate that further increases in BMEP are possible.

The major engine design change made while developing the higher rated engine was to substitute a thin chrome-plated liner for the thick integrally cast cylinder liner. This liner is assembled from the bottom of the cylinder with considerable interference fit. The liner is now held with a bolted clamp ring at the bottom end; the fire seal at the top is a captive copper-ring gasket. These changes overcame difficulties experienced with water leaks and failure to seal against high gas pressures.

FDL-16 Engine Specifications

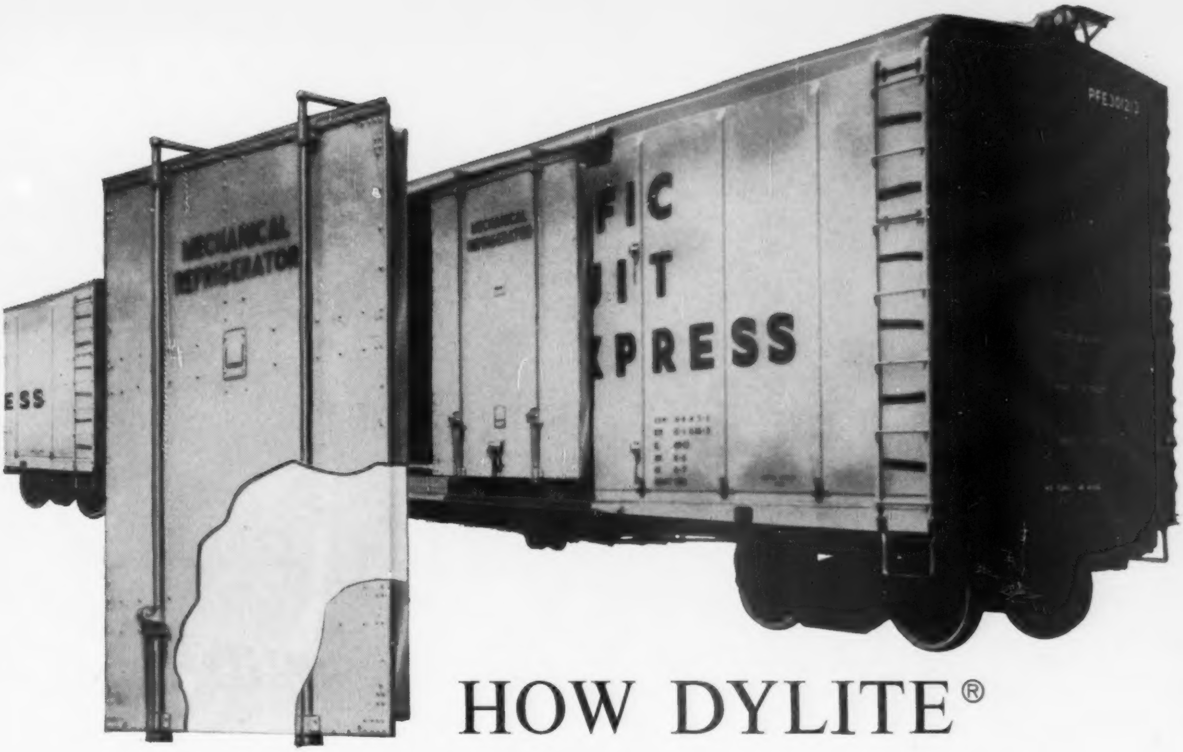
Number of cylinders	16
Gross rating, hp	2,750
Dry weight, lb	38,500
Bore, in.	9
Stroke, in.	10½
Engine speed, rpm	1,000
Valves per cylinder	4
Oil control rings	2
Compression rings	4
Wrist-pin area, sq in.	23.5
Bearing area, sq in.	39
Crank-pin diameter, in.	7 7/16
Main bearing area, sq in.	34
Main bearing diameter, in.	8

Basic advantage of the thin liner construction is that it gives the lowest possible inner wall cylinder temperature at the top of the piston travel where lubrication is marginal at best and where temperatures are high at high outputs. The liner is chrome plated to provide maximum resistance to wear.

Original head covers allowed leakage from the high-pressure fuel-line connections to enter the lube oil and cause excessive dilution. The cover was initially modified to place the high-pressure fuel line and fittings outside the cover and subsequently to allow the cover to be removed without breaking the high-pressure fuel line. Now only one wing nut is used to hold the cover in place.

Replacement of the bronze cam roller bushings on the fuel-pump drive with Lubrited steel bushings solved the problem of failures under the higher loads imposed by the increased engine rating. Other bearing problems

(Continued on page 26)


MECHANICAL REFRIGERATOR
FIC
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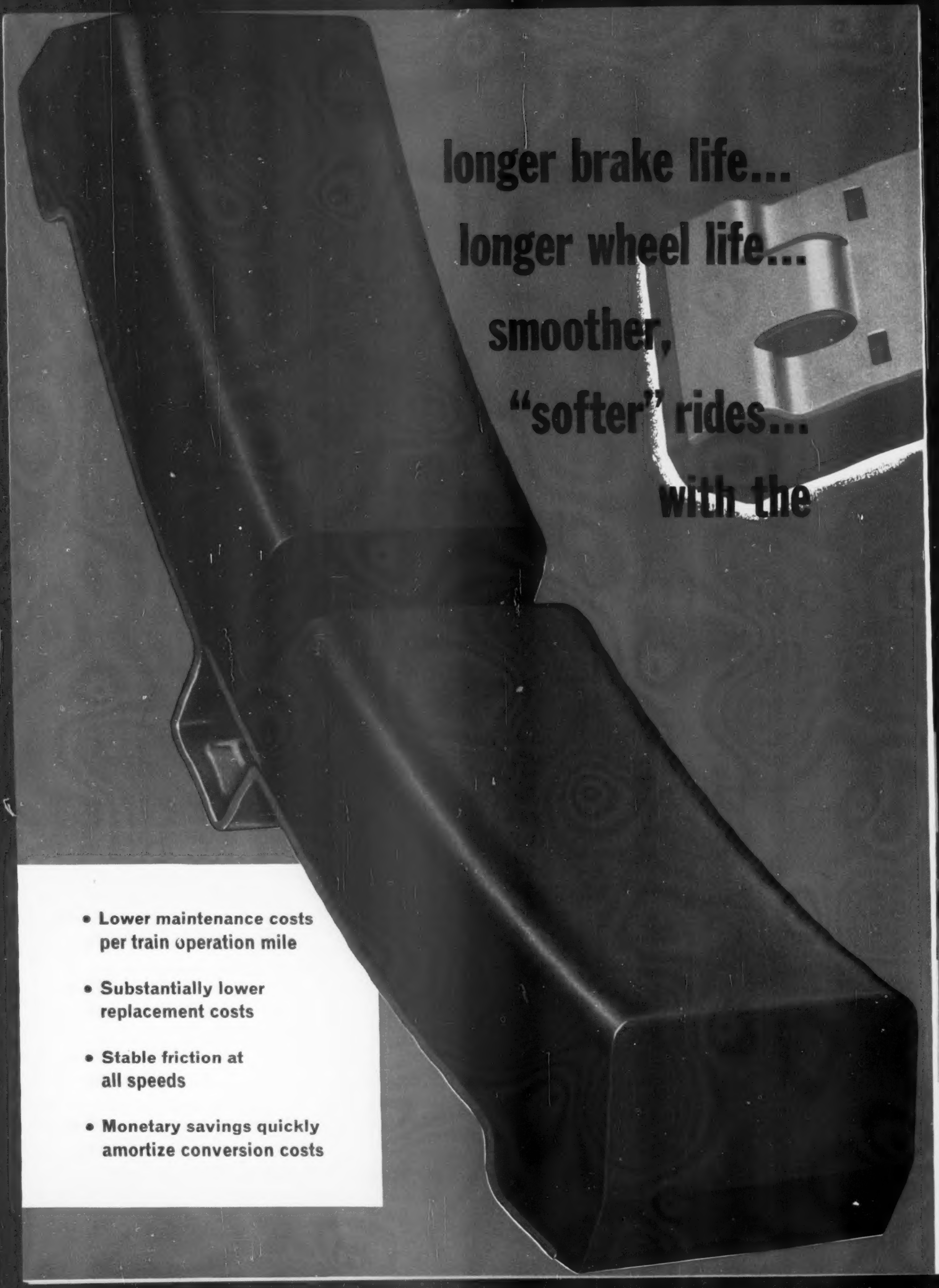

longer brake life...
longer wheel life...
smoother,
"softer" rides...
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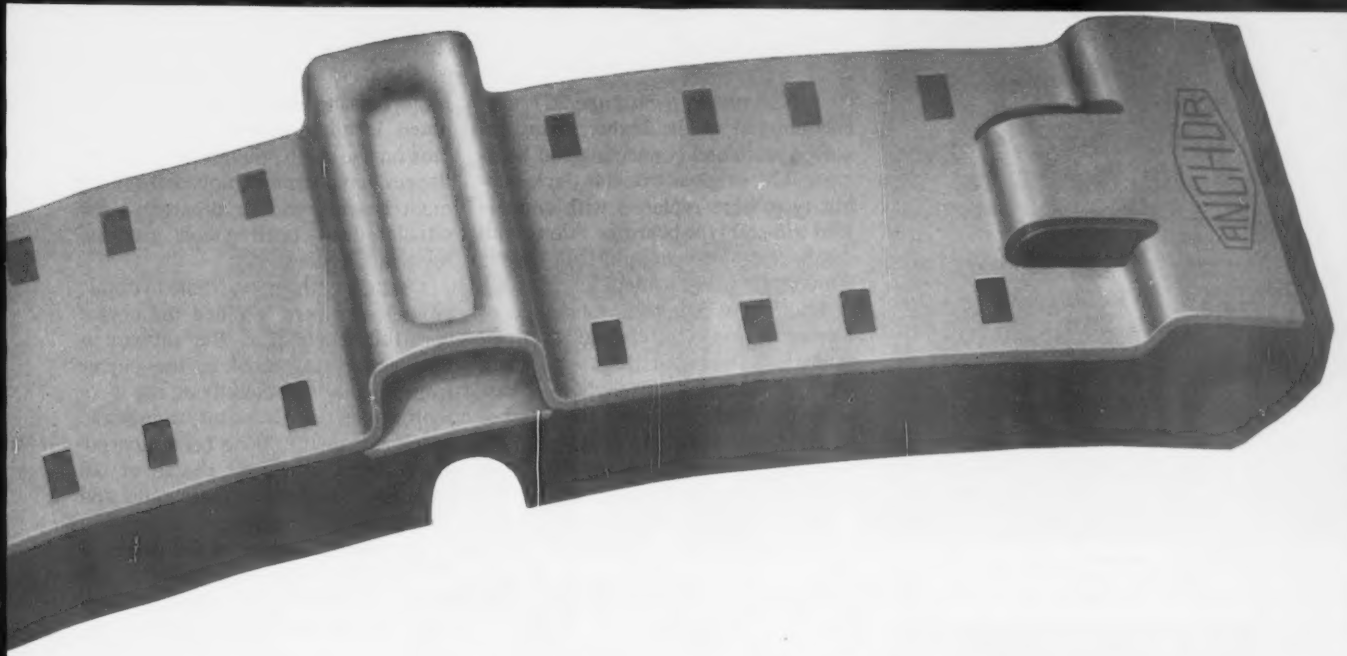
• Lower maintenance costs per train operation mile
• Substantially lower replacement costs
• Stable friction at all speeds
• Monetary savings quickly amortize conversion costs



ANCHOR* COMPOSITION TREAD BRAKE SHOE

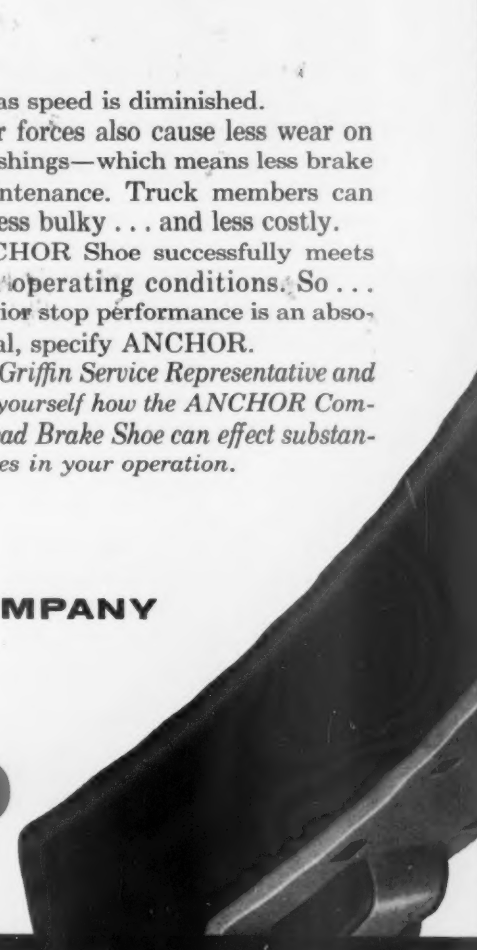
Higher and more uniform friction . . . reliable braking performance under all normal operating conditions—that's the ANCHOR Composition Tread Brake Shoe. (Braking forces required are approximately *one-half* those needed with other shoes for equivalent stop performances.)

This reduced shoe load permits a correlative reduction in the size of the air actuating chamber, or by changing brake mechanism. And there's no need to vary brake cylinder pressure to provide high shoe forces at high speeds, with a corresponding lowering of shoe forces as speed is diminished.

The lower forces also cause less wear on pins and bushings—which means less brake rigging maintenance. Truck members can be lighter, less bulky . . . and less costly.

The ANCHOR Shoe successfully meets any known operating conditions. So . . . where superior stop performance is an absolute essential, specify ANCHOR.

Call your Griffin Service Representative and discover for yourself how the ANCHOR Composition Tread Brake Shoe can effect substantial economies in your operation.



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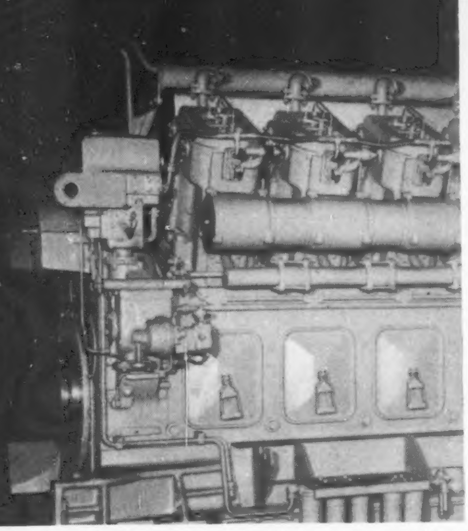
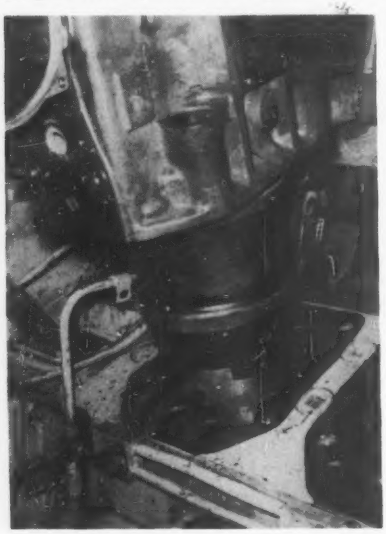


Engine and overspeed governors are driven from single drive unit. Crankcase covers were designed for easy access and explosion relief.



Unit cylinder assembly is lowered over piston with special guide which is shown installed. Air manifold section is integral with head.

Piston inspection and repair can be completed after the unit cylinder assembly is removed.

(Continued from page 22)

encountered at the higher rating involved main and connecting-rod bearings. The original trimetal thick-babbitt type were replaced with copper-lead trimetal type bearings. Along with the bearing changes, journals on the crankshaft were nitrided.

The origial manifold, fabricated of a combination of mild- and stainless-steel plate, had seal rings at the slip joints. Finally, a lightweight stainless-steel manifold with twice the number of pipes was adopted. It is based on well proved aircraft designs and is the standard.

An alloy die-cast sectional air intake manifold was developed to replace the original one-piece design. Each manifold section is removed with its cylinder, giving complete flexibility and simplifying cylinder removal. The first crankcase access doors, secured with a series of bolts and studs, have been replaced with a combination quick-access and explosion-relief door of pressed steel which is operated by a lever and toggle bar. The overspeed shutdown system now consists of a Woodward PSG governor, with a self-contained oil pump supplied with engine lubricating oil, which operates air shut-off butterflies in the turbocharger air discharge elbow.

Because the 16-cylinder engine for domestic use did not have any precedent in U.S. railroad service, there was no interchangeability problem. Therefore, certain major design improvements were incorporated before it was first tested in 1958. Roller bearings, except those in the governor and water pump, have been eliminated. Gear and shaft supports have been greatly simplified. Gear and camshaft adjustments have been eliminated; tram marks indicate the proper gear mesh for engine timing.

Cylinder rocker arms are lubricated by pressurizing the cross-heads and feeding lubricating oil through the push rods. This eliminates external lubricating oil lines on the engine.

Drive gears for the water and lube-oil pumps are mounted on the pump shafts and mesh directly with an idler gear inside the engine front end cover. The pumps fit into accurately located rabbet fits; there is no need for gear-lash adjustment of these assemblies. Governor drive is now a single, externally mounted gear package driving both main and overspeed governors.

Main bearing diameter is 8 in. and the crank-pin diameter is $7\frac{7}{16}$ in. The basic bearing design has now eliminated locating dowels by providing tabs on the shells, themselves. Thrust flanges have been removed from the main bearing with a separate semi-circular thrust bearing now performing this function.

Deepening the main frame to obtain greater stiffness simplified the engine construction, because the subbase is now simply an oil pan; the engine frame is mounted directly on the locomotive platform. Lube oil strainer and pressure regulator have been incorporated internally in the design of the front end cover to eliminate joints and flanges in the oil piping.

An unusual feature of the design is the integral head and cylinder. It might seem that this would increase engine maintenance costs. Statistics indicate that the most frequent maintenance items on an engine are piston rings and valves. Because it is necessary to remove only four hold-down bolts and break the water, air and exhaust manifold connections, an entire cylinder assembly can be removed from the engine by two men in about 15 min.

With the cylinder removed, the piston is exposed and rings can be changed readily. A reconditioned cylinder can then be applied in about the same time. The application of rings can be completed without disturbing rod bearings. With the cylinder removed, valve seat inserts can be replaced readily. The liner is also removable and replaceable in case of damage.

Because the cylinder assembly weighs nearly 600 lb, it is necessary to have tools and fixtures handled by a hoist or a crane for this replacement.

Future uprating of the engine will depend largely on the avilability of improved turbosuperchargers. Pressure ratios of the order of four-to-one are needed to carry the future anticipated higher loads at high altitudes.

Even when output is 25% above the present commercial rating, operation is virtually smoke-free. Smoke limit is not expected to be a factor in determining ultimate engine rating. Low fuel consumption goes with good combustion. The production Type 7 FDL-16 engine operates consistently at full load fuel rates of less than 0.360 lb per bhp-hr with fuel having 19,300 Btu or higher heating value. Idling fuel consumption for this engine as applied in the locomotive is less than 30 lb per hr at 400 rpm.

NATIONAL

1961

ANNUAL REPORT

TO AMERICA'S RAILROADS

93 Years of Service to Transportation and Industry

PRODUCTS • SERVICES • PRODUCT DEVELOPMENT

Transportation Products Division

NATIONAL
MALLEABLE AND STEEL
CASTINGS
COMPANY
Cleveland 6, Ohio

1960 ● ● ● *the year in brief*

National's Technical Center, Cleveland, continued to make substantial contributions to railroading through its large pool of scientific, technical and engineering talent, and its unparalleled physical facilities for conducting projects involving research, development, engineering and advanced testing.

Many of these investigations centered on products of National manufacture, while others involved other makes on a direct-comparison basis in order to upgrade National's product line still further.

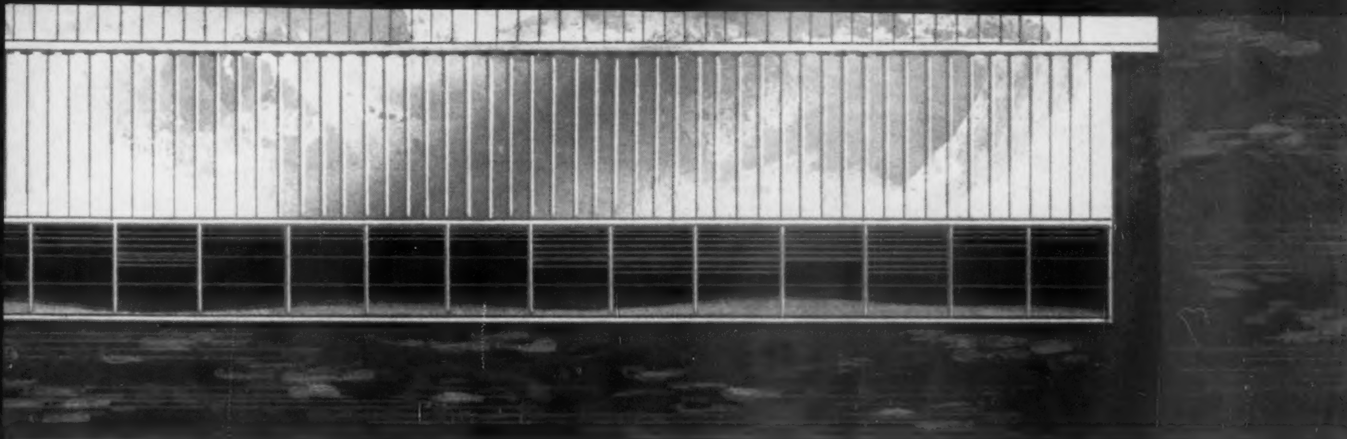
This background of talent, physical facilities and experience form the warp and weft of a pattern of specialized knowledge to be found nowhere else in the railroad equipment field either domestic or foreign.

Field Investigations

Field investigations were performed under both normal day-to-day and extreme operating conditions. Some of these investigations were performed as a routine part of National's continuing customer service program, others at the request of railroads where our representatives acted as trained and impartial observers, still others working in concert with AAR committees.

Contract Research

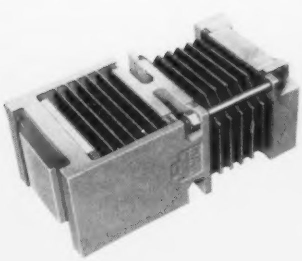
Among the many contract research projects conducted during 1960 were: AAR static tensile design tests on yokes, testing of floor jacks in our million-pound test machine, AAR drop test of knuckle pins, road tests of military trailers, static testing of nailable freight car flooring, impact tests on special rubber cushioning devices, and other investigations of a related nature.

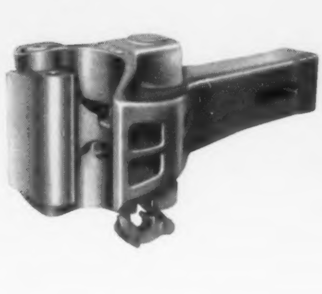


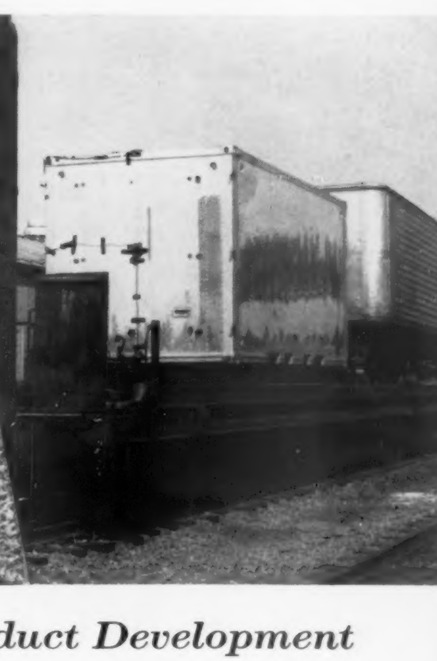
Dedicated to Service and Research

Scientific Research

One of the most important aspects of the Technical Center's activities, scientific research is an area in which it frequently makes some of its most significant contributions to the skill of railroading, as well as to the advancement of engineering technology in many other industries. Research is regularly performed in the areas of mechanics, dynamics, structures, metallurgy, hydraulics and pneumatics, chemistry, electronics and physics — all of it so-called "hard" research with a view to making a better-performing, more saleable product at a lower manufacturing cost.





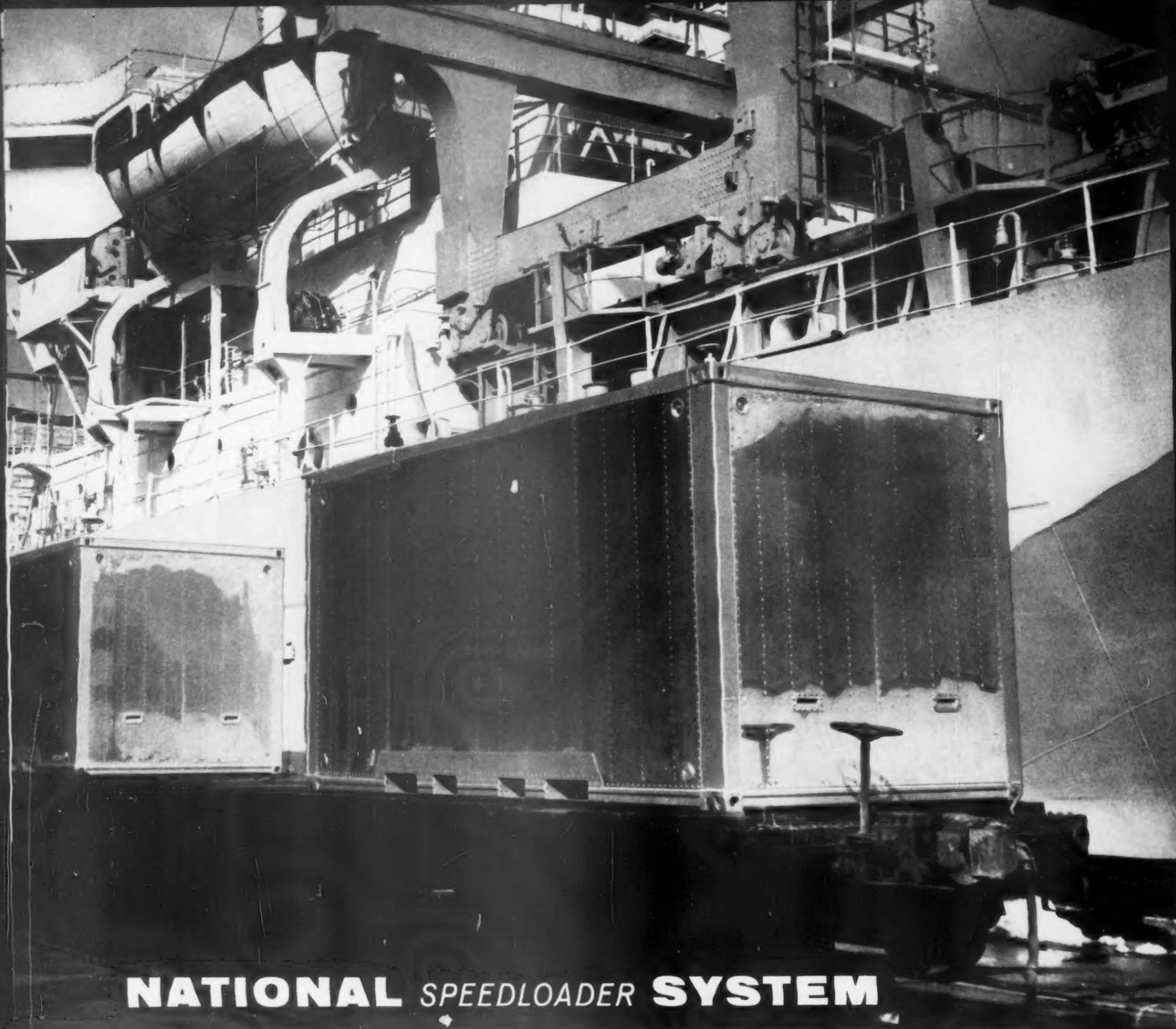


Product Improvements

Planned, systematic product improvement and upgrading programs, embracing every phase of the company's product line, are a dedicated, year-round activity that makes the National trademark unique in the railway equipment industry. A small cross section of 1960 activities includes ultimate load tests on freight car side frames and high tensile steel bolsters for a major western railroad, tests on improved springs for M-17-A friction draft gear, which have subsequently received AAR approval, impact tests on 75-foot TTX cars and on special rubber cushioning devices, static and anti-creep tests on couplers, and many others.

New Product Development

National's new product development program has many facets, both within and without the railroad field. Revolutionary designs are under intensive development and testing in the areas of impact control, protection of car structures and lading, and other devices of a confidential nature to make for better railroading, more economical shipping and handling at lower costs. Coincident with its railroad new product development program, National is also working in other directions involving the marine, automotive and farm equipment fields, and with the military.



Automatic Cargo Container Handling System

Now Fully Developed for Use by Rails, Ships, Trucks, Plants

While the first National Speedloader System installation was designed expressly for a ship operator, National has never lost sight of the fact that containerization of cargo, and its automatic handling, would generate traffic for railroads, and has, consequently, kept the Speedloader design flexible toward this end. During the last year, the National Speedloader System has been steadily improved to the point where it is now fully developed for use by all forms of transportation.

Furthermore, the Speedloader System is compatible for use with present fully automatic or semi-automatic handling methods such as existing cranes, slings, hooks, fork lifts or straddle carriers. Conversion of flatcars or truck trailers for Speedloader operation is a simple matter involving minimum capital investment. Containers, additional cranes or other lifting devices can be purchased competitively from manufacturers of such equipment since the Speedloader components are adaptable to all.

Transportation Products Division

International Division
Cleveland 6, Ohio

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A-3496A

Ken Discovers the A's Have It

An unexpected release of brakes on a passenger train had raised questions about the 26-L air-brake equipment in the minds of Ken and Slim, the road foremen of locomotives for the district. They had turned to George, system air-brake instructor, for an explanation and cure. George told them about the P-2A application valve, an improved design, which was being used on recent 26-L brake installations. The offending passenger unit had been equipped with the P-2 application valve which could, under certain conditions, give a brake release in the course of recovering a penalty brake application. Having described how the P-2A prevented this, George went on to a description of the other brake functions which involve this improved application valve.

This is Part 2 of the fourth installment in a series on the 26-L brake. Part 1 appeared in the December issue, p 30.

"Let's now go into the other features," George said, looking up from the diagrams of the 26-L equipment which were spread out on his desk. "Before going any further, we should look at the valve and piping diagram. You will notice that when a locomotive is equipped with a P-2-A application valve, only two Relayair valves are needed instead of the three which are required when using the P-2 valve. Note also that less piping is involved."

"I can see that," said Slim. "What are the 'additional functions' you were mentioning?"

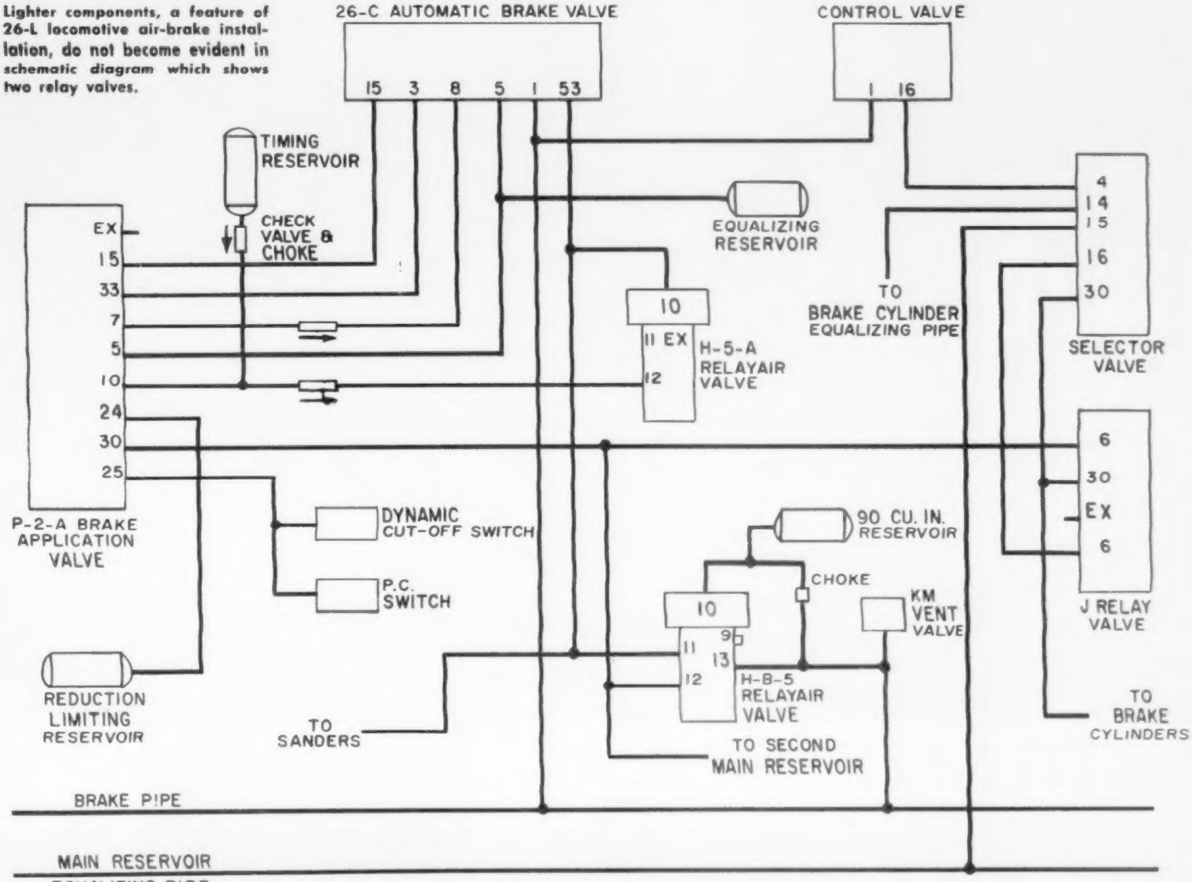
George went on to explain that, on locomotives equipped with 26-L equipment, break-in-two protection can be accomplished by various Relayair valve arrangements which result in "power knockout" (PC) or dynamic cut-off and an emergency brake application.

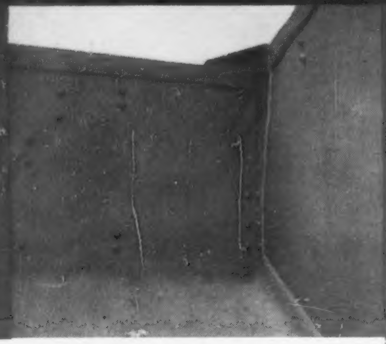
On a locomotive equipped for safety control—one having the P-2 or P-2-A Brake Application Valve-break-in-two protection can be provided with a simple arrangement of Relayair valves connected to the brake pipe and the application valve. They are sensitive to an emergency rate of brake-pipe reduction which would occur during a break-in-two.

Locomotives for m-u operation have an F-1 Selector Valve connected to the main reservoir equalizing pipe. When a break-in-two occurs between two 26-L locomotives or between a leading 6-SL locomotive and a trailing 26-L unit, loss of main reservoir equalizing air will cause the F-1 selector valve on the trailing locomotive to assume a *Lead* position, which allows control air from the control valve on the locomotive to flow to the relay valve and apply the brakes. An F-1 selector valve so positioned prevents the loss of brake-cylinder equalizing air.

(Continued on page 34)

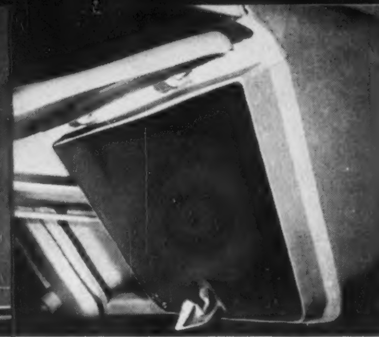
Lighter components, a feature of 26-L locomotive air-brake installation, do not become evident in schematic diagram which shows two relay valves.





FEATURE: Extra Strength. An inside band, in addition to the usual corner cap, gives added strength to inside top corners where ordinary hopper cars often fail. This construction "extra" is typical of the attention-to-detail that gives PS-3s rugged durability.

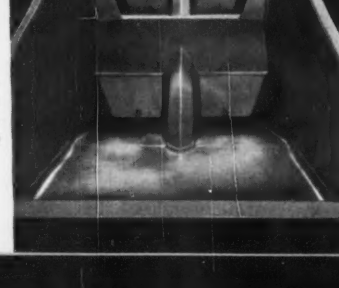
FEATURE: Extra Service. Vertical embossments pressed into side sheets between side posts minimize flutter under shake-out machine use and increase service life to sides. Quality features such as this assure purchasers maximum value when they buy PS-3s.



FEATURE: Extra Stamina. Typical of PS-3 stamina are the hopper chutes and doors; both of ⅜" plate. High strength steel door frames are welded to the chutes inside and outside to provide strong, crevice-free, corrosion resistant joints.

ANOTHER BENEFIT OF P-S FULL LINE STANDARDIZATION

the rugged durability of...



FEATURE: Extra Cleanliness. Smooth floor sheets with longitudinal welds and rounded flanges at sides cause no material-retaining ledges or pockets to encourage corrosion or slow unloading processes.

PS3

Durability is another of the many built-in and proved characteristics of the standardized Pullman-Standard PS-3 Hopper Car.

This feature, along with high availability and low maintenance performance, is common to the full line of P-S standardized rolling stock. But, due to the punishing demands of hopper car service, durability is a prime requirement of hopper cars and it shows up at its best in the standardized PS-3.

Hopper Cars

3 HOPPER . . . *70-ton Capacity*

Close attention to every design and construction detail results in the kind of durability that keeps maintenance at a minimum; keeps the PS-3 in revenue producing service. Such items as solid crossridge braces, butt welded plates, flanged floor sheet edges and smooth hopper chutes, all result in faster, cleaner unloading and greater shipper acceptance. Embossed side sheets, rugged inside corner bands in addition to corner caps, flanged hood sheets, high mounted air brake reservoir and heavy-duty hopper chute plates and doors with high strength steel door frames provide longer in-service life, low maintenance . . . rugged durability. Investment in Pullman-Standard PS-3s will prove to be a wise addition to your hopper car fleet.

THIS FOLDER YOURS. The whole story of PS-3 Hopper Cars . . . features, construction, specifications, dimensions. See how the PS-3 can result in more revenue per car-dollar. Write today.

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J. C. Fennelly Company, San Francisco, Representative

Ken Discovers the A's Have It

(Continued from page 31)

"To explain the operation and to illustrate all the features of the break-in-two protection on a 26-L locomotive," George said, "we will study one arranged for safety control, multiple-unit, and break-in-two protection. This unit will be equipped with the basic 26-L equipment, plus a P-2A brake-application valve, an F-1 Selector Valve, one H-5-A Relayair Valve, and one H-B-5 Relayair Valve."

During normal operation with brake valve in release position, the brake pipe is fully charged along with pipes 10 and 13 to the HB-5 Relayair Valve and the 90-cu in, reservoir. The H-B-5 Relayair valve will be in its upper position. With the Relayair valve in this position, main reservoir supply in port 12 of the Relayair valve is cut off at the valve and port 11 is connected to port 9. The P-2-A brake application valve is charged, and the spring chamber and timing reservoir air are connected to port 12 of the H-5-A Relayair valve. Main reservoir air will flow from port 3 in the brake valve to port 33 of the P-2A Brake Application Valve and then to the top of the release control valve.

Nullifying Dynamic Brake

If a break-in-two occurs, the break-in-two features are actuated to nullify the dynamic brake or cause power knockout. Control and selector valves function to give an emergency brake application. Brake-pipe air pressure in pipe 13 to the H-B-5 Relayair valve drops rapidly, reducing pressure in the spring chamber. Pressure in the 90-cu in. reservoir, along with that in port 10 of the H-B-5 Relayair valve, begins to drop. The choke fitting causes air to exhaust to the brake pipe very slowly. Pressure retained in port 10 and above the diaphragm of the H-B-5 Relayair valve forces the piston down, connecting main reservoir air in port 12 to port 11.

Main reservoir air supplied to port 11 in the H-B-5 Relayair valve flows to several components:

- To sanding reservoir and then to sanders;
- To port 53 in the brake valve and then to the brake-pipe cut-off valve in the brake valve, closing the cut-off valve to prevent further brake-pipe charging; also from port 53 to an exhaust port in the brake-valve cut-off valve giving engineman an audible warning of a break-in-two;
- To port 10 of the H-5-A Relayair valve, then to the chamber above the diaphragm and piston where pressure forces the piston to its lower position; air from the P-2-A valve-spring chamber and timing reservoir connected to port 12 of the H-5-A Relayair valve flows past the open lower valve to port 11 and atmosphere; a pressure differential is established across the diaphragm sufficient to cause it and its attached spool valve to be moved upwards to its application position.

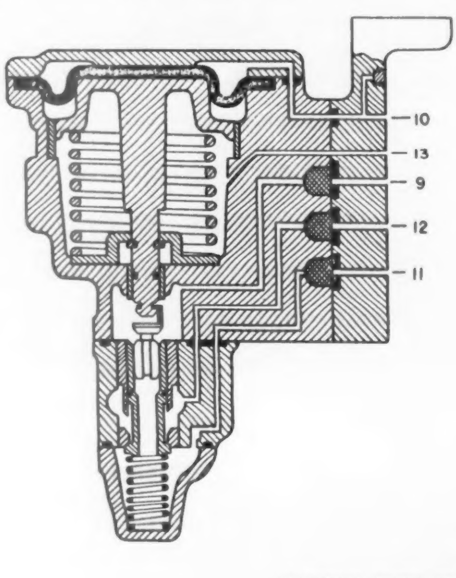
In application position, the spool valve makes several connections. Main reservoir air in port 30 and in the chamber beneath the diaphragm is connected to port 25, actuating the PC and dynamic cut-off switches. Main reservoir air in port 30 through choke and port 10A is connected to port 8. The chamber on the spring side of the diaphragms and the timing reservoir volume are connected to port 8, which is connected to lock-over pipe 8 in the brake valve. This connection is normally vented to atmosphere through the suppression valve when the automatic brake-valve handle is in release position.

Equalizing reservoir charging via port 15 or the brake valve and port 15 and 5 of the P-2-A brake-application valve is cut off. Equalizing reservoir air in port 5 is connected through the spool valve to port 24A via a choke and through port 24 to the reduction limiting reservoir. Equalizing reservoir air is allowed to equalize at a controlled rate in the reduction limiting reservoir to produce a full service brake application.

When a break-in-two occurs, brake-pipe pressure in port 1 of the control valve will be reduced at an emergency rate, placing the control valve in emergency position. Control air from port 16 of the control valve will flow to port 4 of the F-1 selector valve. The selector valve positioned in *Lead* position allows the control air to flow through the spool valve to port 16 and then to port 16 of the relay valve. The relay valve is actuated and allows main reservoir supply in port 6 of the relay valve to flow to port 30 and the brake cylinders, giving an emergency brake application. Brake-cylinder air also flows to port 30 of the F-1 selector valve.

When a break-in-two occurs between two 26-L locomotives, or between a leading 6-SL locomotive and a 26-L trailing locomotive, pressure is reduced in the main reservoir equalizing pipe which vents air from connection 15 of the F-1 selector valve and the chamber below the protection spool valve which is forced to its lower position by spring tension. On a leading locomotive, the flow of brake-cylinder air from port 30 of the relay valve via port 30 of the F-1 selector valve to brake-cylinder equalizing pipe connection 14 of F-1 selector valve is cut off by protection spool valve.

(Continued on page 44)



H-B-5 Relayair valve functions to afford protection during any unexpected separation between the units of a muntiple-unit locomotive. Sanders are also supplied with air through it.

Birth of a blue-ribbon roller-bearing axle

Wham! goes the wallop of the 10,000-lb. hammer and another Bethlehem roller-bearing axle begins to take shape. The die has two grooves, one to form the journal and one for the body. After one half of the axle is formed, the bloom is turned end-for-end, and the other half is similarly shaped.

This is just one step in the most modern roller-bearing axle setup in the world. The recent completion of Bethlehem's modernization program at Johnstown, Pa., brought about a realignment of operations, along with the installation of the latest in high-speed machines, to permit smooth progression of work to the highest quality standards.

You can order freight car roller-bearing axles to either AAR Standard or Alternate Standard. You can also look to us for complete finish-machining of roller-bearing axles for freight cars, passenger cars and diesel locomotives, as well as plain-journal freight car axles.

A Bethlehem engineer will be glad to discuss your axle needs with you. Just get in touch with our nearest office, or drop a line to the address below.

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On Canadian National Refrigerator Cars . . .

Cushioned Racks Cut Lading Damage

Elimination of damage to dressed beef occurring during shipment in refrigerator cars has been a problem confronting American railroads for years. The Canadian National soon will have 27 cars in service in which 10-ft sections of the overhead meat racks at the ends of the cars are spring mounted. Tests on two of these 40-ft cars, which were rebuilt with this vibration damping system, have been so encouraging that the road has undertaken the rebuilding of 25 additional cars with the same arrangement.

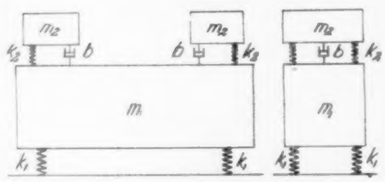
According to the CNR, the use of the vibration absorber which these spring-mounted racks form has proved to be an economical and effective short-term solution for the beef-damage problem. It is easily applied, but the system is not applicable to all types of loads requiring protection from vertical vibration.

Initially, it was believed that longitudinal impacts were the cause of beef damage in transit and that an underframe cushioning device would be necessary to prevent damage. The study actually indicates that the cause is probably inadequacy in truck design. Opinion on the Canadian National is that "there is an urgent need for improvement in the riding qualities of existing freight-car trucks, particularly in the high-speed ranges, so that all fragile commodities may be protected adequately."

While cost of beef-damage claims is small, the CNR is concerned about diversion of this traffic to other transportation agencies and is interested in regaining traffic already lost.

The dressed-beef traffic considered in the study originated either at Edmonton, Alberta, or Winnipeg, Man., and was shipped to Montreal, Que., distances of 2,160 and 1,360 miles, respectively. All cars arriving in Montreal with damaged beef were inspected. Either the meat hook tears through the ribs of the front quarter, or the beef jumps from the hook or the rack and falls to the floor.

From a paper by W. H. Cyr, chief mechanical engineer, Canadian National, presented before the recent meeting of the Railroad Division, ASME.



Frahm dynamic vibration absorber was adapted for railroad application by CNR. Auxiliary masses m_2 mounted atop the primary mass m_1 serve to prevent resonance in the system.

Over 100 cars were investigated at Montreal, and the following pattern was established:

- Invariably damage was confined to the ends of the car;
- Damage occurred in cars either with 2½- or 3⅛-in. spring-travel trucks equipped with built-in snubbers;
- Inspections revealed no single defect which could be associated with poor riding;
- Several different loading methods were tested and all were susceptible to damage.

It was suspected that the damage was caused by impacts. On 40 trips cars carried impact recorders. When it was not possible to establish a relationship between the severity of impacts and beef damage, two road tests were conducted on trains carrying carloads of hung beef between Edmonton and Montreal to learn more of the effects of speed on the riding qualities of refrigerator cars. There were continuous records of longitudinal impacts, vertical vibrations, and train speed. Loads were checked at each division point.

There were no overspeed impacts during these tests and yet beef was damaged. Vertical acceleration increased with speed, but did not appear to be excessive until the train speed exceeded 50 mph. Between 55 and 60 mph, the magnitude increased appreciably and, as 60 mph was reached, a rhythmic motion with high acceleration was observed. Inspections at division points confirmed that damage occurred only when the train speed exceeded 50 mph for appreciable periods.

It became apparent that the primary cause of damage was vertical vibration, not impacts. The road test indicated that, at high speed, the car body can be subjected to a resonant condition of vertical vibration.

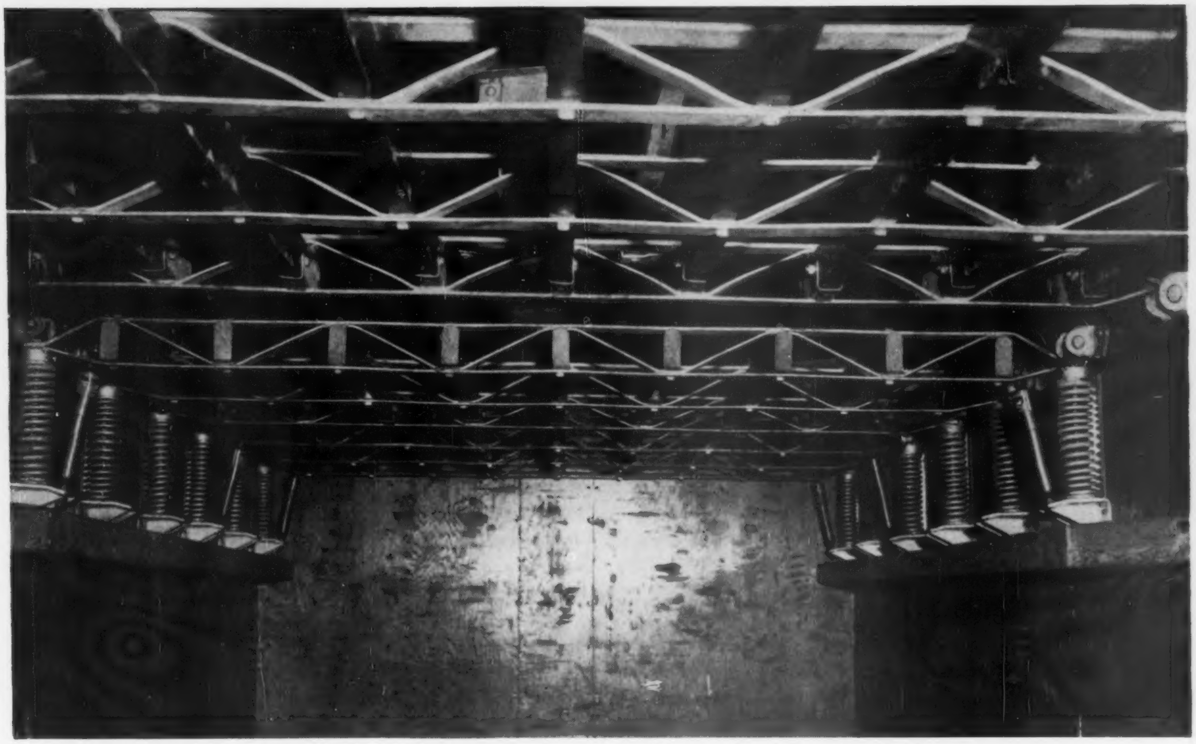
A rail vehicle is a complex system with many degrees of freedom. For practical consideration, the system may be considered as having three types of motion which can exist independently, each with its own natural frequency. These are bounce, pitch, and roll. Under bounce or linear vibration, the springs in each truck move vertically in phase, while under pitch or rotational vibration, the springs in one truck move vertically 180 deg out of phase with the springs in the other truck. When the car is subjected to roll, the springs at one side of a truck move out of phase with the springs on the other side of the same truck. Under normal operating speeds, all three types of vibration occur simultaneously. Each will tend to become predominant when the exciting frequency due to the wavy nature of the track profile under dynamic loading coincides with the corresponding natural frequency, a condition known as resonance. Assuming that the exciting force originates at the rail joints, every half rail length, or 19.5 ft, resonance for roll is reached at 14 mph; for bounce, at 42 mph, and for pitch, at 58 mph.

Resonant Speed

Tests showed that, at 60 mph, severe vertical vibrations were set up in the car which caused a marked increase in the damage to the dressed-beef load. Calculations now indicated that resonant pitching motion could be set up in the 60 mph range. The amplitudes of vibration would be greatest at ends of the car.

These conclusions were substantiated by a further test which was set up to compare the records of damage to beef shipped at a 50-mph speed limit to beef shipped at a 60-mph speed limit. Damage was cut by a factor of at least 2 when the 50 mph limit was observed.

Forces transmitted to the load due to vertical vibrations developed at high speed might be reduced by using



Spring-mounted racks—one 10-ft length in each end of 40-ft car—proved sufficient to control damaging vibration.

truck springs with a considerably softer spring rate so that the speed at which resonance occurs would be well below the normal operating range. To reduce the resonant-pitch frequency of the refrigerator car to 10 mph, a spring with a static deflection of 32 in. would be required. Such a spring could not be applied to existing truck side frames because of space limitations. The difference between the empty and full-load static deflections would exceed the 2-in. allowable variation in coupler height.

A secondary means of isolating vibrations had to be considered. The dynamic vibration absorber, invented by Hermann Frahm in 1900, provides an effective method for eliminating undesirable resonance. The most effective arrangement of the absorber system involves suspending two identical masses from the main car body, one at each end of the car. When the absorber system is arranged in this manner, it is possible to control bounce and pitch effectively. The function of the absorber system under each type of motion is as follows:

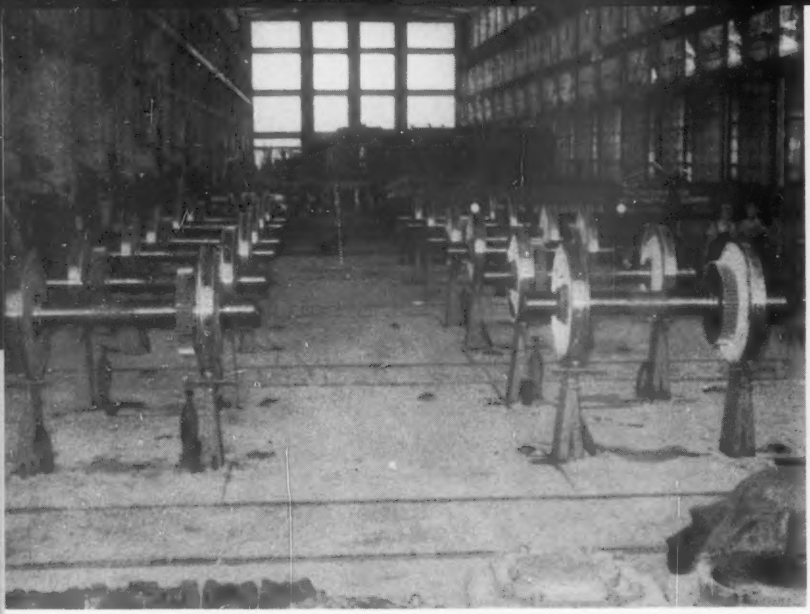
When the car body is subjected to bounce or linear motion, the absorber masses move vertically in phase with each other, but 180 deg out of phase with the truck springs.

When the car body is subjected to pitch, one set of truck springs moves 180 deg out of phase with the other and, because the absorber springs must always be out of phase with the truck springs below it, the absorber springs must also be out of phase with each other. Optimum tuning is first calculated separately for bounce and pitch. The value of optimum tuning used in the design of the auxiliary springs must be a compromise and is the average of the optimum tuning calculated to control bounce and pitch separately.

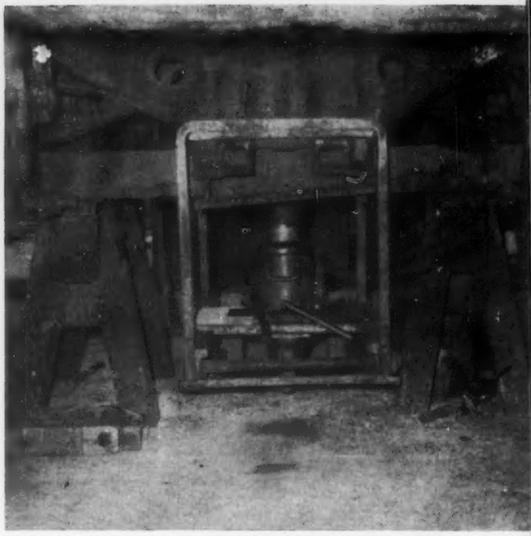
A vibration absorber designed in this manner would be effective at two points, but viscous damping must be added to make it effective over the full frequency range. A dynamic vibration absorber may be readily applied to a refrigerator car loaded with hung beef because it is symmetrical about the center of gravity and the lading weight is always approximately the same. If the meat racks at each end of the car are cushioned with appropriate springs and dampers, the beef hung on each of these sections will act as an absorber mass, without adding additional weight to the car.

To minimize the cost of equipping a car with cushioned meat racks, the absorber system was designed to make use of the existing wall brackets and rack trusses. This meant that the distance between the absorber springs and dampers was fixed. This limited the effectiveness of the system to control the roll motion, but this was not considered serious because detrimental effect of roll on the hung beef load was not found to be significant. Adequate protection was achieved by cushioning only two 10-ft sections of the meat rack, one at each end of the car. The components of the vibration absorber were designed to be attached between the existing wall brackets and the rack trusses. The cushioned sections are free to vibrate independently of each other and of the car body, acting as a support for the absorber mass in eliminating resonant vibrations and providing the required protection.

During a five-month period the two cars made 30 revenue trips between Edmonton and Montreal without any evidence of damage. Latest figures showed that, out of 60 loads moved, there was damage to three. The damage occurred when the racks were not fully loaded. This damping system does require that the absorbing masses —the loaded meat racks—have the total weight for which the system was designed.



Stands hold wheel sets in position for assembly of trucks. Each stand has a compressed air outlet which makes it easy to use pneumatic tools during assembly.



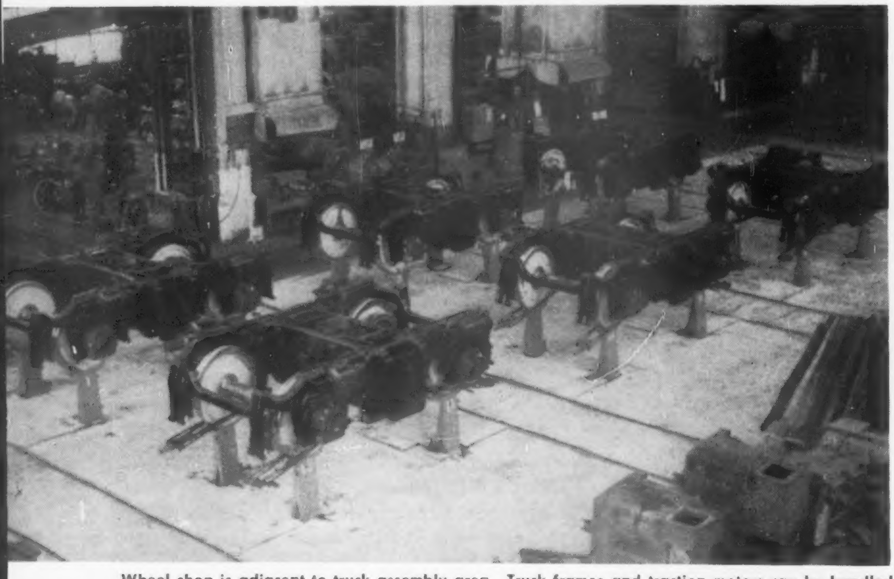
Clamping device hooks into nose spring pocket and its jack then compresses elliptical truck springs.

Diesel Truck Assembly at AT&SF Shop

More economical diesel-truck overhauls and safer and cleaner working conditions are the results of the rearrangement of the truck repair area in the Cleburne, Tex., shop of the Santa Fe. The truck stands, designed for working four-wheel trucks of General Motors locomotives, have made it possible to get truck work out of pits and off the floor. These stands are adjacent to the wheel shop and are operated on an assembly-line basis.

Tracks from the truck stands lead directly into the wheel shop. One is permanently assigned to the transfer of worn wheels into the shop and another for the return of new or turned wheels to the truck overhaul area. Supervisors rate this arrangement as one of the best labor savers at the Cleburne shop.

Each of the six truck stands is anchored in concrete and is 31 in. high. Compressed air lines extend under floor to each stand. This simplifies the use of pneumatic tools and jacks.



Wheel shop is adjacent to truck assembly area. Truck frames and traction motors can be handled with overhead crane in the main shop where trucks are rebuilt and repaired.

All trucks go to this area for inspection and repair. They are placed on stands with the overhead crane. Each workman is thoroughly trained to perform his assignment; a truck is completely stripped in about 40 min.

As trucks are stripped, the components are delivered to cleaning vats outside the shop. After cleaning, they are returned for inspection and overhaul. Disassembly of the truck frame after it is lifted from the wheels is completed by placing it on tripods. A portable clamp, equipped with hydraulic jack, is rolled under the frame and hooked on the nose spring pocket. When the jack compresses the spring plank toward the bolster, swing hangers are released. Truck frame, bolster, and spring plank are separated in only a few minutes.

In assembling the trucks, turned wheel sets are placed on the stands and the journal boxes are applied. Rebuilding of trucks is a procedure which, in general, reverses the stripping procedure.

After the assembly is completed and the motors installed, a power jack is placed under each pair of wheels so that a welding machine can rotate it, making possible a test of all bearings and the gear case. When the truck comes back to the shop floor from the stand in the overhaul area, it is ready to be painted and installed under a diesel unit.

ELECTRICAL SECTION

NYC Utilizes Latest Techniques

Traction motor and main generator shops have been testing and adopting new materials and methods

How shop practices can meet changing requirements is demonstrated at the traction motor and main generator shops of the New York Central. These facilities are part of the road's Collinwood shop at Cleveland, Ohio. They were set up nine years ago as the NYC completed the conversion of its maintenance facilities for the handling of diesel locomotives. Since then, numerous new procedures and improved materials have been tested, and many have been adopted as standard.

The shop operates on a budget basis, including cost of labor, material, and overhead. Department heads set their own budget goals for each six-months' period. The present plan is to establish an annual increase in budget efficiency. Past performance indicates that some percentage of increase in efficiency each year is a practicable goal.

Present work load involves the overhauling of six traction motors per day and twelve generators per month. One traction motor armature is rewound each day.

Motors and generators brought in at the receiving section of the shop are first given a visual inspection. Resistance readings of insulation are made, and all data is recorded on the permanent record which is kept for each machine. Motors are then cleaned in the vapor degreaser with trichlorethylene before disassembly. Motor armatures are degreased after disassembly if additional cleaning is required. Generators are disassembled before degreasing. Subsequent shop procedures for the overhaul of main generators and traction motors are quite similar.

Traction-motor pinions are removed with an induction-type pinion heater. Wedges are then tapped between the heated pinion and the motor frame. Motor support bearing alignment is checked by means of two special metal spools and a mating steel tube. To do this, the bearing caps are released and one spool is placed inside each bearing housing. The cap is then tightened and the steel tube pushed through the center holes of the spools. Misalignment of the bearings would be indicated by binding of the tube. Distortion of the bearing housing is checked by use of a feeler gauge around the outside diameter of the spool.

On Our Cover

Support bearing alignment is checked at Collinwood by placing spools inside the bearings, tightening bearing caps, and then passing tube through the spools.

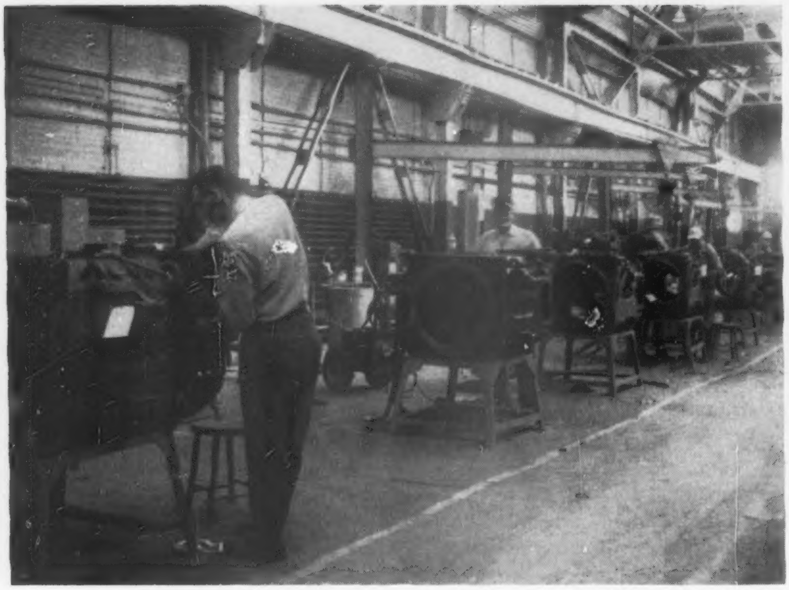
Armature bearings are cleaned, inspected, and oiled. If their condition is good, they are turned 90 deg and reapplied. The inner races are changed if necessary. When more extensive repairs are required, bearings are returned to manufacturers. If their condition does not warrant remanufacture, they are scrapped.

Motor and generator frames and armatures are cleaned in a blowout booth after degreasing. They are then moved to their respective reconditioning stations.

Armatures are tested both with a

Glass tape is now replacing steel bands on all rewound armatures as they undergo rebuilding at the New York Central Collinwood shop.

High-frequency machine is used for all commutator soldering. Shop has been progressively equipped with latest tools since it was built.



Motor assembly takes place in one section of shop. Opposite side is equipped for the repair of armatures and frames. NYC makes extensive use of cranes and other handling devices.

megger and d-c high-potential tester. If their condition is satisfactory, they are vacuum impregnated with clear baking varnish and baked in one of the shop's three ovens. If an armature has low resistance reading, it is baked in the oven, after which it is again tested. If satisfactory, it is varnished and baked. If an armature is grounded or shorted, it becomes necessary to strip it for rewinding. End coils are cut with a carbide-tipped saw, and the coils are pulled with a hoist and come-along. Epoxy insulation does not prevent pulling coils in this manner, but necessitates some extra cleaning. This is done by dipping the core section vertically into a lye vat up to the commutator, using a special jig. The remaining bits of insulation and varnish may then be removed easily and the slots cleaned with a wire brush.

Armatures are rewound with kits. Temporary wire bands are re-rolled on the armature to pull coils tight in the slots. These are removed and permanent glass-tape bands applied at 400 lb tension. All rewound armatures receive two varnish and baking cycles. Final d-c hi-pot and megger tests are made before assembly. Commutators are turned and undercut. Stringbands are replaced and coated with epoxy resin while the armature is rotated under heat lamps. If steel bands are in good condition, the commutator end band is epoxy coated while the armature is rotated under heat lamps. This has proved effective in reducing damage caused by flashovers. The armature is then balanced and is ready for reassembly.

Armature collars, retainers, and frame heads are cleaned in a Vapor Blast machine. The blast consists of an abrasive material in suspension in a liquid. After cleaning, the parts are rinsed with rust inhibitor. Brush holders are disassembled and cleaned in an acid cleaner. All porcelain studs are replaced with polyester glass studs. Worn parts are replaced and spring tensions adjusted.

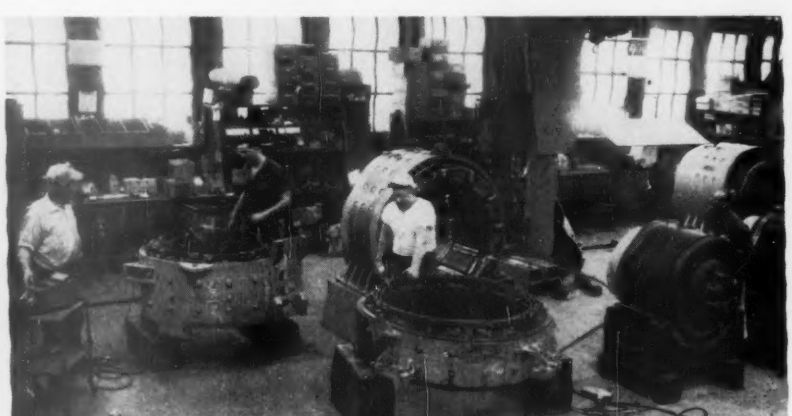
Field coils are first given insulation tests. If the insulation is sound, leads between coils are reinsulated. Outside leads, field coils, and pole pieces are replaced if necessary. No field coils are reinsulated. Replacement consists of epoxy-insulated coils supplied by a manufacturer or outside repair shop. All replacement coils are tested at 1,000 volts while submerged in water before being used. The assembled motor frame is then impregnated in varnish and baked.

The motor, after final assembly, is given a run-in test under load which consists of high field current and full armature voltage, each supplied by separate generators. After the test, motors are given final megger and d-c hi-pot tests. Exposed metal parts are coated with protective grease.

Motors are shipped to installation points on special skids. These skids are designed so they may be picked up from any of the four sides by a fork lift truck. This aids materially in placing them in a car.

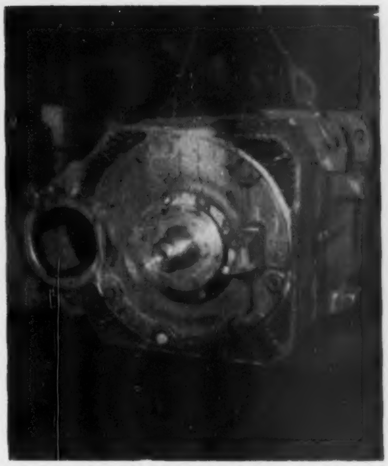
Main generator overhaul is essentially the same as that for traction motors, but generators are not given a running test.

Shop-built positioner simplifies the disassembly of the heaviest diesel main generators.



Process for rebuilding main generators is similar to that used for traction motors. Frame at left is being given insulation resistance test with motor-driven megger testing device.

Induction heater is used for removing pinion after preliminary inspection is completed.



Motor is cleaned in vapor degreaser after the pinion has been removed.

Bearings are cleaned in Magnus agitator-type cleaning tank after motor has been torn down.

Miscellaneous motor parts are cleaned in Vapor Blast cabinet, then coated with rust inhibitor.

Armature core, held in jig, is immersed in lye bath to strip all epoxy after coil removal.

Metal portions of brush rigging are acid cleaned and polyester glass replaces porcelain studs.

Reclaimable commutator-end steel bands are coated with epoxy and baked.

High-potential tests in the shop are all made with a direct-current type testing device.

Skid used for shipping motors can be picked up from any side by fork-lift trucks.

Doc's Governor Trouble

By Gordon Taylor

It had been a rough day at the Diesel House in Centerville. General Foreman Bob Davis concluded that surely there was nothing more which could possibly happen. There was. His clerk handed him a message telling him that CWC 36, the fast freight, would arrive shortly with trouble on its lead unit. It was thought the unit had a cracked piston, and Davis was to make preparations to take this unit off the train and replace it with another.

After checking his power board, Davis instructed one of his men to use a 1,500-hp Alco A unit as the replacement. It would be coupled on while the locomotive was being fueled. As the train pulled up at the fueling station, it proved to have a five-unit locomotive headed by an EMD F-7 A unit which was followed by an EMD F-7 B unit, two Alco B units, and an Alco A unit.

The Alco A unit being used as the replacement was ready with its engine running. It took its place at the front of the locomotive as soon as the F-7 A unit could be set out. When the Alco's control jumper was connected with the trailing F-7 B unit and the engineman opened the throttle, engine speed on the Alco became erratic. The engine began to "hunt" and the overspeed switch opened.

Foreman Davis had gone to the service track to supervise the changing of units. He immediately told one of his maintainers to try another control jumper. Trading cables made no difference; the overspeed switch continued to kick out. The Alco unit was uncouped from the train, and Davis discovered there was no overspeed trouble when the jumper cable was disconnected from the other units.

Because the maintainers could not locate the source of the Alco's trouble, another A unit was substituted and, after an hour's delay, CWC 36 left town. Foreman Davis now had the problem of finding what was wrong with his Alco A unit, as well as replacing the piston on the F-7. Looking over the list of units on hand, he found he had an Alco B unit. He instructed his men to couple the troublesome Alco A unit with it. It was of no comfort for Davis to observe that these two units worked together without difficulty. "It certainly looks as though the engine on this A unit would rather go 'hunting' than help the other units haul CWC 36," he observed. "Just put this troublemaker in the diesel house. Doc Watts, the electrical foreman, will be here in the morning and we will have him see what's wrong."

The following day when Doc Watts heard the story, he explained, "There are a number of things that can cause an Alco engine to 'hunt.' One of the principal causes can be dirty governor oil gumming the plungers and ports in the governor pilot valves so they stick. Engine speed will then go up and down continually. The governor is trying to find a balance point, but its erratic pilot valves cause it to overshoot balance points. Here we can dismiss dirt in the governor oil, because there was no trouble when the jumper cable was disconnected from the units on CWC 36. We will have to check electrical control circuits to solve this case," Doc concluded.

"I wish you would tell us how you go about analyzing a case of this kind," Bob Davis responded.

"OK," said Doc; "we will start with known facts. This unit worked OK until it was connected with the trailing units on CWC 36. It worked properly when connected with that Alco B unit. Something must be wrong on the Alco A unit which requires a jumper connection with other units to upset engine control system. But remember that when it was connected to the Alco B unit there was no trouble. This leads us to the conclusion that part of the trouble exists on the Alco A unit and another part of the trouble was due to some defective wiring condition on one of the trailing units on CWC 36.

"Let's look," continued Doc, "at part of this Alco engine control system. Its engine governor controls fuel supply to the engine and adjusts engine speed to a constant value for each position of the throttle. There is a *fixed* speed for *each* throttle position. The amount of fuel fed to the engine controls its speed. There must be some way for the correct engine speed to be indicated to the governor at each instant so it will know what to do.

"This calls for a speed signal from the engine such as might be shown by a tachometer. That signal must be transmitted automatically from the engine to the governor. This is provided by the tachometer generator which is driven directly by the engine and produces voltage that varies directly with the engine speed. The higher the engine speed, the higher the 'tac' generator voltage. The tachometer generator is a three-phase a-c generator with a permanent magnet field connected to a rectifier to produce direct current for a portion of the control circuit of the engine governor.

"There is also a special pilot valve in the governor, whose job it is to control engine speed. This is really an oil valve operated by electric current which flows through a speed coil solenoid in response to the voltage produced by the 'tac' generator. Current from the 'tac' generator flows through the speed coil solenoid to magnetize and move its core, which is connected to the stem of the pilot valve. This, in turn, opens the ports in pilot valve to admit governor oil at 125 psi pressure against the governor power piston which is linked to the fuel control racks that, in turn, are linked with fuel injector units to admit more or less fuel as load varies.

"The speed solenoid valve, while operated by current from the 'tac' generator, has its action restrained by a stabilizing coil (mounted on same frame with speed coil) which acts as an 'electric dashpot' to keep the speed coil from overshooting its mark when it is operating to increase or decrease the fuel supply to the engine. The stabilizing coil never overcomes the speed coil, but it serves as a damper to make the speed coil go easy on fuel changes. What energizes the stabilizing coil? It is energized with current from the battery. This means that a condition which interferes with the battery-fed control circuit could mean interference with the stabilizing coil and thus might upset engine speed control.

"I know that an open circuit, or a

faulty winding, in the stabilizing speed coil would cause 'hunting' and could cause the overspeed switch to open. This coil could not be defective on our unit, because the governor worked properly when the jumper cable was disconnected from the trailing units on CWC 36. I would now look for grounded wiring that could provide a bypass or leakage circuit around the stabilizing coil to weaken its action. This could make the speed coil overshoot and permit the engine to overspeed.

"Facts in this case lead me to believe that a grounded condition of the positive lead, tapped from wire 71, to the stabilizing coil may be grounded on this Alco. This would cause no interference until a grounded circuit was established on the negative side of the stabilizing coil connecting with No. 4 trunk wire. Apparently it took a jumper cable connection with a unit having a grounded negative wire to complete a sneak circuit around the stabilizing coil.

"Now it is time to stop talking and make some tests to see if our theory is of any value," Doc said. "We'll start with wires that start from the engine control panel on the side wall of engine room and lead to the speed pilot valve stabilizing coil. There is more to the governor than the speed pilot valve, but let's look at the portion most likely involved."

When the circuit was carefully examined and tested, it was found that the wire feeding the stabilizing coil was "grounded" on the engine panel and had the effect of establishing a ground at what we may consider the positive end of the coil. "We don't have the units from CWC 36 to connect with this one," Doc explained, "so we'll deliberately put a test jumper between 'ground' and the No. 4 trunk wire to see what happens."

When this was done, the engine again decided to go "hunting." The mystery had been solved by Doc's clear thinking. All that remained was to clear the ground on the wire leading to the stabilizing coil and remove the temporary ground test wire from its connection with the No. 4 wire. A notice was then posted to watch for the return of the units from CWC 36 so the negative ground could be located and cleared on the faulty unit.

"Many thanks, Doc, for showing us how to talk ourselves into finding the cause of a peculiar case of trouble," Bob Davis said. Turning, he asked Electrician Bill Sparks, "What did you get from this demonstration of talking yourself into finding electrical trouble?"

"Well, sir," replied Sparks, "I learned that I should not put my tongue in gear until I get my brain started. Otherwise, I may talk myself into more trouble."

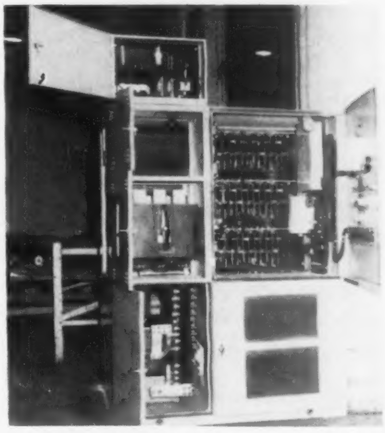
We can wrap this case up by saying that it is very important to keep control circuits free of grounds and to remember that it may require grounds on two units to establish a case of trouble on one unit. It is also good to remember that one of the best tools a trouble shooter has is a clear understanding of the functions of the equipment with which he is working. It is that understanding that accounts for his reputation as a lucky trouble shooter.

Rectifier for Clinchfield Shop Power

Silicon rectifiers are of growing importance in the supply of d-c power. A 300-kw Allis-Chalmers unit was recently installed in the Erwin, Tenn., shop of the Clinchfield. This was part of a shop modernization program which was undertaken by the road several years ago. During the course of this work, the steam heating systems for the railroad's buildings at Erwin were rearranged to make their operation more economical. Latest step in this drive for greater efficiency was the installation of the solid-state rectifier to supply power for shop cranes and other d-c machines.

In 1958, a central heating system, consisting of two oil-fired, automatic Amesteam generators, was installed to heat the Erwin shop, the general office building, and the passenger station. This made possible the retirement of two hand-fired boilers in the shop powerhouse, one stoker-fired boiler in the general office building, and one stoker-fired furnace in the station. The change produced labor savings of approximately $15,000 annually.

Although the Clinchfield receives its a-c power from the TVA system and its d-c power generation has not involved the use of steam for a number of years, it was necessary to retain a powerhouse attendant to operate the motor-generator sets used to produce direct current for overhead cranes and other shop machinery.



Rectifier unit is installed in shop building.

The new rectifier has now replaced the motor generator sets. The package unit requires no special foundation and has been located in the main shop, near the load center. The d-c power is transmitted for only short distances. The unit is air cooled, which simplified the installation. There are few auxiliary devices, a feature contributing to reduced maintenance.

The 300-kw unit is equipped with a regenerative load absorbing device that protects against a rising bus voltage. This regenerative unit throws resistance across the line and cuts in and out automatically at pre-set levels of bus voltage and current.

Diode balancing reactors make it necessary to use matched cells. Fast current limiting fuses assure immediate isolation of a faulted cell without interruption of the d-c output. A primary circuit breaker provides quick fault protection and positive overcurrent protection. The silicon diodes have an almost unlimited life when operated within their current ratings. Such silicon rectifiers are 85 to 97% efficient and between 25 and 100% load.

In addition to the efficiency and dependability with which d-c power is now produced, the completely automatic operation of this unit is producing labor savings of $5,000 annually.

The A's Have It

(Continued from page 34)

On a trailing locomotive with the F-1 selector valve positioned *Trail 6* or *26*, the protection-spool valve will vent air from the chamber below the right-hand spool valve which will be forced by spring pressure to its lower position, as in *Lead* position to connect ports 4 and 16. Control air pressure developed by the 26F control valve is transferred to the relay valve control pipe as it is on a lead locomotive, actuating the relay valve to cause an emergency brake application on the trailing unit.

Recovering Control

If a break-in-two should occur between two units, locate its cause and make repairs which will close all the open pipes. Because the brake-pipe air on top of the H-B-5 Relayair valve diaphragm and in the 90-cu in. reservoir has been drained to zero, the Relayair valve moves to its upper position, cutting off main reservoir supply in port 12 to port 11. This cuts off flow of air to the sanders, to port 10 of the H-5-A Relayair valve, and to port 53 of the brake valve.

Air on top of the H-5-A Relayair diaphragm will flow to atmosphere via pipe 53 and a choke in the brake valve. Air behind the brake valve cut-off valve will also flow through the same choke to atmosphere. The piston of the H-5-A Relayair valve will move to its upper position, cutting off the flow of air to atmosphere from the P-2A brake application valve spring chamber and timing reservoir.

To reset the P-2A brake application valve to restore the PC and dynamic cut-off switches, the brake-valve handle is placed in *Suppression* position. This will prevent the exhausting of air from port 8 of the P-2A brake-application valve. Air from the top of the release control valve portion of the P-2A brake-application valve and port 33 of the P-2A brake-application valve will flow to port 3 of the brake valve and to atmosphere through the suppression spool valve.

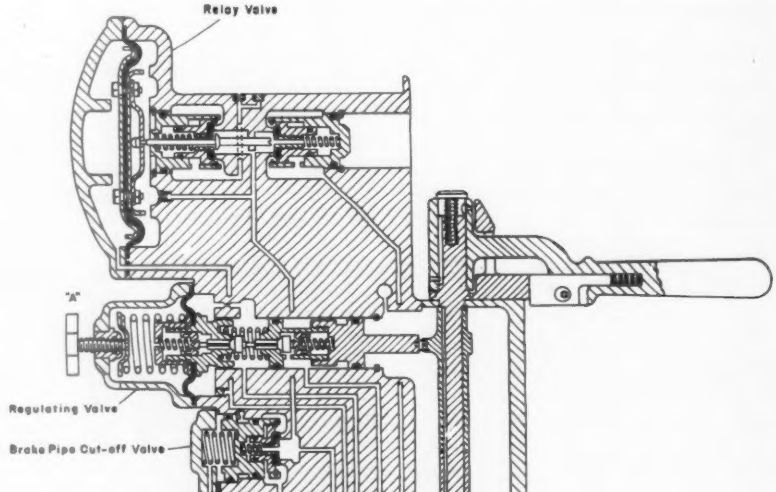
Main reservoir supply in pipe 30 of the P-2A brake-application valve will charge the spring chamber and the timing reservoir and also supply air to the chamber under the release control valve, moving the release control valve to its uppermost position. This positively cuts off feed from pipe 15, the equalizing charging pipe, to pipe 5 and prevents undesired recharge of the equalizing reservoir. This prevents partial release of the brakes in passenger service.

With the spring chamber of the P-2A brake-application valve charged, the application valve will move down to its release position, disconnecting ports 30 from 25 and connecting port 25 to exhaust. Air on the PC and dynamic cut-off switches will flow to atmosphere and allow the switches to reset. Ports 5 and 24A are disconnected. Port 24 and the reduction limiting reservoir are connected to exhaust.

Moving the brake-valve handle to *Running* position, air in pipe 8 and at the bottom of the release control valve will flow to atmosphere through the suppression valve. Main reservoir supply from port 3 in the brake valve to port 33 in the P-2A brake-application valve will flow to the chamber on top of the release control valve, moving the release control valve down, allow equalizing charging pipe 15 to connect with equalizing reservoir pipe 5, and charging the equalizing reservoir. The brakes will then release.

George asked Ken and Slim if there were any questions. Slim replied, "Don't worry; we will be back again. Rome wasn't built in one day."

On the way back to their office, Ken said, "George really knows his brakes. We'd better get rid of all the P-2 application valves on passenger locomotives and apply the P-2A valves."



26-C control valve is designed to be flush-mounted on the locomotive control panel.

What's New

(*Continued from page 11*)

to furnish a continuous supply of oil to the entire pad length. The outer cover is oil-absorbent lint free tufting. The foam rubber core is said to have the required resiliency at subzero temperatures. The lubricator is AAR approved for test application in interchange. *Spring Packing Corp., Dept. RA, 332 S. Michigan Ave., Chicago 4.*

Portable Sandblaster

The Handi-Blast portable sandblaster cleans cement, rust, and paint from tools and equipment, leaving a clean, dry etched surface that provides an excellent bond for new paint. The unit requires no more air than a production spray gun. It has an over-all height of 23 in. and a tank diameter of 7 in. Weight is 23 lb empty, with a capacity of 30 lb of abrasives in the 20 to 100 mesh size. Each unit is tested at 300 psi. Air is consumed at the rate of approximately 8 cu ft per min, using the $^{3}/_{32}$ in. nozzle and the air supply from a 2 hp compressor. A $^{5}/_{32}$ in. nozzle will consume approximately 20 cu ft per min, requiring an air supply from a 5-hp compressor. *Handi-Blast Div., Hamill Manufacturing Co., Dept. RLC, Washington, Mich.*

Fabricating Tool

Most Heliarc (Tig) welding torches, including those in service, may now be used both for welding and cutting. Complete fabrication, from cutting of metal to final welding into a finished product, can now be accomplished with a single torch. Either manual operation or mechanized fixturing may be used. Cutting is done by increasing current density above that for good welding conditions, utilizing Linde argon-hydrogen shielding mixtures. Normal gas flow rates (40-60 cfh) are sufficient to transfer energy across the arc and displace the molten metal. Any standard d-c power equipment with a 70-volt open circuit may be used for Heliarc cutting of metals within a range of ⅛ to ½ in. thick. Typical cutting speeds are 40-60 ipm on ⅛-in. aluminum and 20-40 ipm on ⅛-in. stainless steel, using H-35 shielding gas. *Linde Co., Division of Union Carbide Corp., Dept. RLC, 270 Park ave., New York 17.*

Letters

(*Continued from page 7*)

The following are significant excerpts from the conclusions reached as a result of these tests:

"When considering the total oil consumed (including oil lost in all tests with 1-in. to 0-in. to 1 in. oil levels, the roll waste packing showed the lowest consumption of oil. When considering the total oil consumed (including oil lost) in all tests with from ½-in. to 0-in. to ½-in. oil levels, the average oil consumed per box with lubricators was less than that consumed with roll waste packing, and five of the seven lubricators showed less oil consumption than roll waste packing."

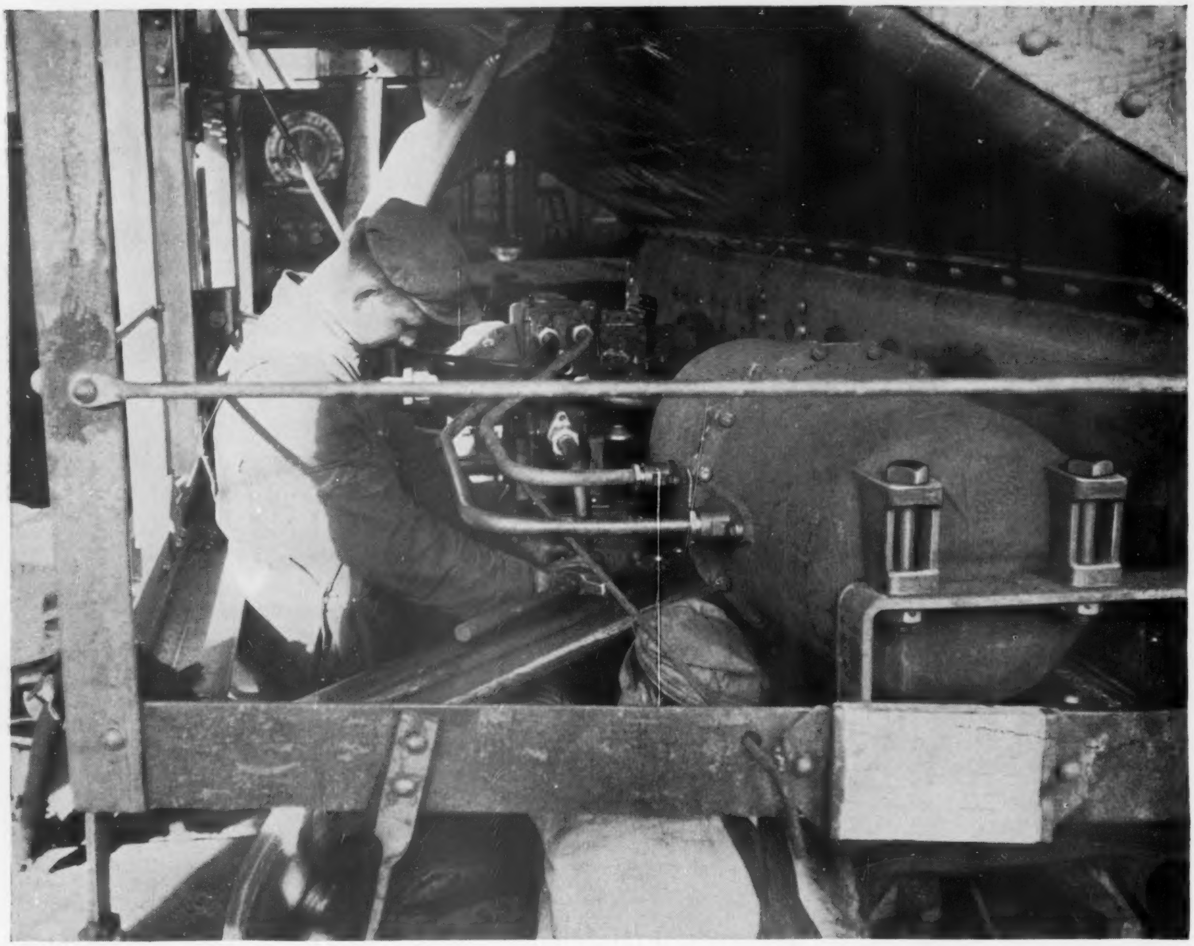
"There was no abnormal increase in the journal-bearing temperature when the tests were conducted with free oil levels of ½ in. or lower."

"The results obtained in this test indicate that we could expect a 55% reduction in the amount of oil lost and consumed in lubrication by lowering the free oil level in the bottom of the journal boxes from a level of 1 in. maximum to a level of ½ in. maximum."

The actual data obtained during these tests showed that the average oil consumption per mile per box during nine tests with free oil in the journal box from 1 in. to 0 in. and back again to 1 in. in ¼ in. increments was .0069 oz for the boxes with the seven lubricators compared with .0036 oz for the roll-packed boxes. For the five tests with free oil levels from ½ in. to 0 in. and back to ½ in. in ¼-in. increments, the average consumption of oil for the boxes with the seven lubricators was .0031 oz per mile per box compared with .0033 oz with the roll-packed boxes.

From the above data it may be observed that, for boxes equipped with journal lubricators with free-oil level maintained at not more than ½ in., the oil consumption actually is lower than for roll-waste packed boxes maintained at either 1 in. or ½ in. maximum free-oil level. It, therefore, appears that the answer to the problem is available and that, in essence, the problem is one of avoiding over-oiling of journal boxes equipped with lubricator pads.

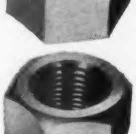
M. A. Pinney
Engineer of tests, Pennsylvania



there are two safe lock nuts for air brake equipment that are also the most economical

The *M·F Uni-Torque* lock nut. Prevailing torque lock nut that will withstand terrific vibration and shock loading.

The *M·F Two-Way* lock nut. Has the added speed of either-end application, and the *center* lock permits bolt end to be flush with the top of the nut.



BOTH PROVIDE COMPLETE RELIABILITY AT LOW COST

The *M·F Uni-Torque* and *Two-Way* lock nuts are *all-metal*, deflected thread lock nuts—a locking principle with a successful record of more than 40 years of safe fastening for air brake equipment.

These *proven* lock nuts combine *reliability* with a very substantial savings over the non-metallic type.

Why spend *more* to sacrifice proven protection?

Personal Mention

Chesapeake & Ohio.—*Huntington, W. Va.:* MILO F. MELROSE appointed engineer of tests, succeeding C. M. ANGEL, retired.

Denver & Rio Grande Western.—*Salt Lake City, Utah:* PAUL D. STARR, appointed master mechanic, succeeding EARL FISHER, retired. Mr. Starr formerly electrical engineer at Denver, Colo.

Elgin, Joliet & Eastern.—*Gary, Ind.:* JAMES V. BODINE appointed enginehouse foreman, Kirk yard. VINCENT R. NELSON appointed relief enginhouse foreman, Kirk yard.

Frisco.—*Springfield, Mo.:* L. I. BUFFINGTON appointed assistant to chief mechanical officer.

New York Central. — *Weehawken, N. J.:* CHARLES W. COLE appointed master mechanic. *Syracuse, N. Y.:* DONALD A. SWANSON appointed district car inspector, succeeding Mr. Cole. Formerly district car inspector at Cleveland.

R. M. Pilcher

Norfolk & Western.—*Roanoke, Va.:* ROBERT M. PILCHER, assistant engineer of tests, appointed engineer of tests, succeeding I. N. MOSELEY, retired research and test engineer.

Mr. Pilcher worked in Roanoke shops while attending VPI from 1918 through 1923. He became a special apprentice in the shops in 1926; shop inspector in 1928, and assistant engineer of tests in 1929.

Pennsylvania. — *Philadelphia, Pa.:* N. L. BISHOP appointed assistant road foreman of engines. *Enola, Pa.:* H. E. BRITE appointed assistant road foreman of engines. *Hagerstown, Md.:* E. L. PRICE appointed motive-power foreman.

Richmond, Fredericksburg & Potomac.—*Richmond, Va.:* HARTWELL T. RAINEY, JR., superintendent motive power and equipment, appointed chief mechanical officer.

Southern. — *Atlanta, Ga.:* WILLIAM H. FLETCHER appointed general foreman car repairs. Formerly general foreman at Monroe, Va.

Wabash.—*Decatur, Ill.:* B. J. PAYNE, general superintendent motive power, appointed manager—motive power and car equipment. A. L. VEITH, assistant general superintendent motive power, appointed assistant manager—motive power and car equipment. E. EAGLETON, car shop superintendent, appointed superintendent car equipment. R. N. FOSTER, assistant to general superintendent motive power, appointed mechanical engineer. H. C. STOREY

appointed general foreman, car shops. *Montpelier, Ohio:* A. T. SCHERER appointed master mechanic. *Owosso, Mich.:* H. L. WINGFIELD appointed master mechanic. *Moberly, Mo.:* W. C. HALL appointed assistant master mechanic. *Chicago:* W. D. LAFFERTY appointed general car and locomotive foreman.

White Pass & Yukon Route. — *Skagway, Alaska:* G. G. POE appointed master mechanic.

Supply Trade Notes

SHERWIN-WILLIAMS CO. — *E. Colin Baldwin,* vice-president and general manager, elected president, succeeding *Arthur W. Steudel,* now chairman of the board and chief executive officer.

AIR REDUCTION SALES CO. — *A. S. Blodget, Jr.,* appointed regional vice-president, Midwestern Region, Chicago, succeeding *D. D. Spoor,* retired.

TOWNSEND CO.—*P. F. Barry,* appointed assistant sales manager, Engineered Fasteners Division, Ellwood City, Pa. *R. M. Thompson,* sales office manager at Chicago, appointed eastern district sales manager in Philadelphia, Pa., succeeding Mr. Barry.

WINE RAILWAY APPLIANCE CO., DIVISION OF UNITCAST CORP. — *Robert M. Close,* St. Louis Railway Supply Co., appointed agent in St. Louis, Central and Southwestern territories.

VASCOLOY - RAMET. — Following appointed sales agents for railroad tooling: *T. C. Johnson Co.,* Chagrin Falls, Ohio; *Ross Co.,* St. Louis; *Harbil, Inc.,* Chicago; *R. Lightfoot,* Louisville, Ky., and *Mountain Region Supply,* Omaha, Neb. Newly appointed distributors for railroad tooling: *Tool Supply Co.,* Minneapolis, Minn., and *Kirk-Wiklund & Co.,* Kansas City, Mo.

BUDD CO. — *Joseph F. Clary* appointed vice-president sales, Railway Division, Philadelphia, Pa. Formerly a divisional vice-president in charge of Western region railway sales.

BUFFALO BRAKE CO.—*D. F. Gladwell,* engineer, appointed chief engineer, New York.

WHITING CORP.—*T. R. Elmblad* and *A. C. Kukral* appointed manager New York Domestic and Cleveland sales offices, respectively.

ARMSTRONG CORK CO.—*A. J. Slosser,* manager of industrial adhesive sales, appointed manager of new Railroad Adhesive Sales department.

AMERICAN BRAKE SHOE CO.—*Charles P. Corrigan* appointed sales manager, Railroad Products Division, Central Region, succeeding *R. L. Robinson,* retired. Headquarters, Chicago. Mr. Corrigan previously district sales manager in Eastern Region.

STANDARD RAILWAY EQUIPMENT DIV., STANRAY CORP.—*James S. Swann*, chief product engineer, appointed director of newly formed Transportation Equipment Research Group.

R. Lindenhayen, Jr.

NATIONAL CARBON CO., DIVISION OF UNION CARBIDE CORP.—*Rolf Lindenhayen, Jr.*, named western division manager, brush and railroad products at San Francisco.

▪

GENERAL STEEL CASTINGS CORP.—*W. Ashley Gray, Jr.*, vice-president railroad sales, named vice-president and assistant to the president, with responsibilities at executive management level. *Howard F. Park, Jr.*, continues as vice-president sales. *Thomas C. Barton* named manager western sales. At Eddystone, Pa., *Delancey J. Davis* appointed general manager; *Robert Wetherill, III*, works manager; *Frank W. Tolan*, manager eastern sales, and *Clemson N. Page*, district manager railroad sales.

▪

ST. LOUIS CAR CO., SUBSIDIARY OF GENERAL STEEL CASTINGS CORP.—*James Macdonald* named senior vice-president and *Winthrop B. Reed*, vice-president. Both are vice-presidents of General Steel. *J. W. Cooke* named vice-president, continuing also as assistant vice-president of General Steel. *Edwin B. Meissner, Jr.*, continues as president of St. Louis Car.

Helps from Manufacturers

The following compilation of literature—including pamphlets and data sheets—is offered free to railroad men by manufacturers to the railroad industry. To receive the desired information write direct to the manufacturer.

WIRE AND CABLE. Bulletin discusses Okonite Del diesel-electric locomotive wire cable, with dimensional charts both for braided and non-braided constructions. (Write: *Okonite Co., Subsidiary of Kennecott Copper Corp.*, Dept. RLC, 220 Passaic st., Passaic, N. J.)

ADHESIVES. 12-page catalog (A-ZBD-104-JR) contains eight fold-out tables listing uses, characteristics and general properties of over 170 different adhesives, coatings and sealers. (Write: *Adhesives, Coatings and Sealers Div., Minnesota Mining & Manufacturing Co.*, Dept. RLC, 900 Bush ave., St. Paul 6, Minn.)

HOSE STYLE SELECTION. Bulletin 627 is a Guide for Selecting the Aeroquip Hose Style to use with 112 common agents. (Write: *Aeroquip Corp.*, Dept. RLC, Jackson, Mich.)

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